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a, me, I, mine, my, ah! Oh!

a, me, I; aenef, he said

a, old age

a, Oh! hail! ah!

a, glory, praise, adore

aw, " " "

a, dew, to bedew

aha, cow-flesh

aha, a cow

apt, a duck

am, pleasant, graceful

a, to wash

aa, a gazelle, a cow

aa, old age

aa, dew, to bedew, to wash

aa, an island, the coast

aa, a bird

aa, a plant

" "

aa, old, an elder

aat, place house, locality

" " " "

" " " "

aa t, place, house, locality

aa t, fruitful

aa, to be

aa, the upholder of honor

aati, the abode of Osiris

arti a garment

aabi, a monster, a beast

aahbes, a calf

aak, old, a magus

aak, a genie

aakebi, aakebu, to lament

aaker, an edible plant

aakt, a reed

aanw, to prefer, to please, beauty

aanw, to noose, to tie, to bind, attach

aamt, to prefer, to please, beauty

" " " "

aari, fæces

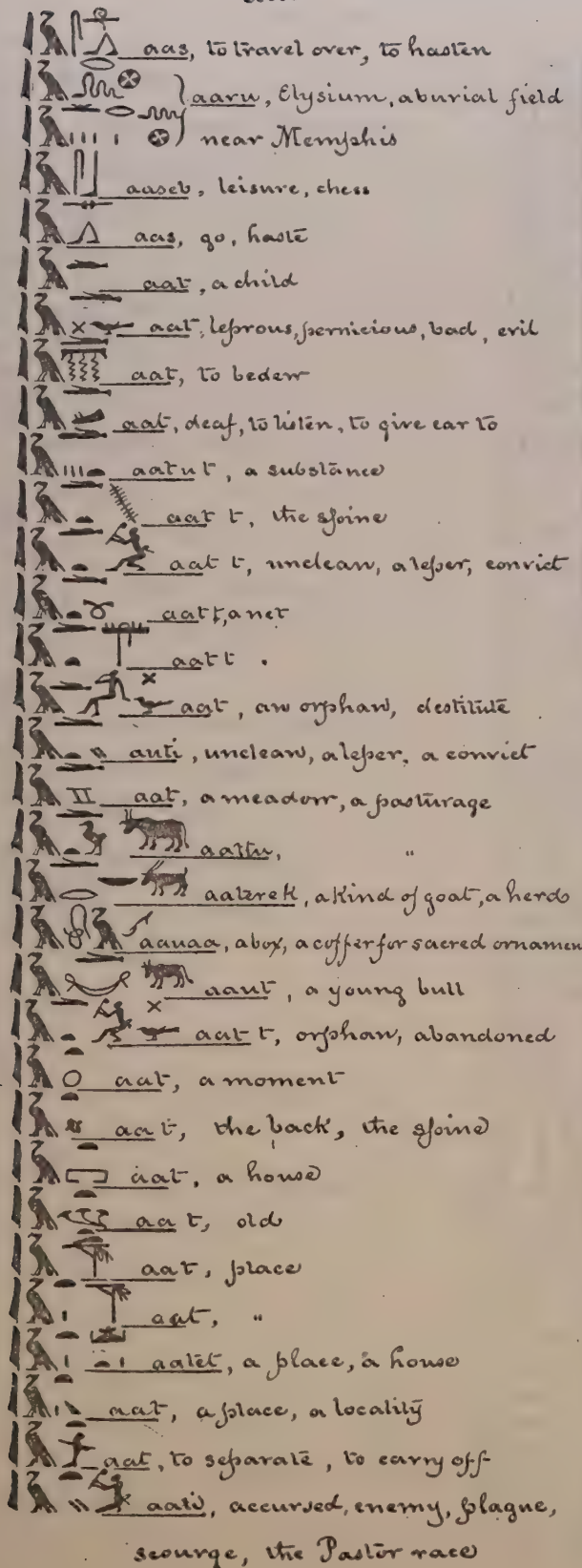
aarer, the pupil of the eye

aarer, a shoot, a pod

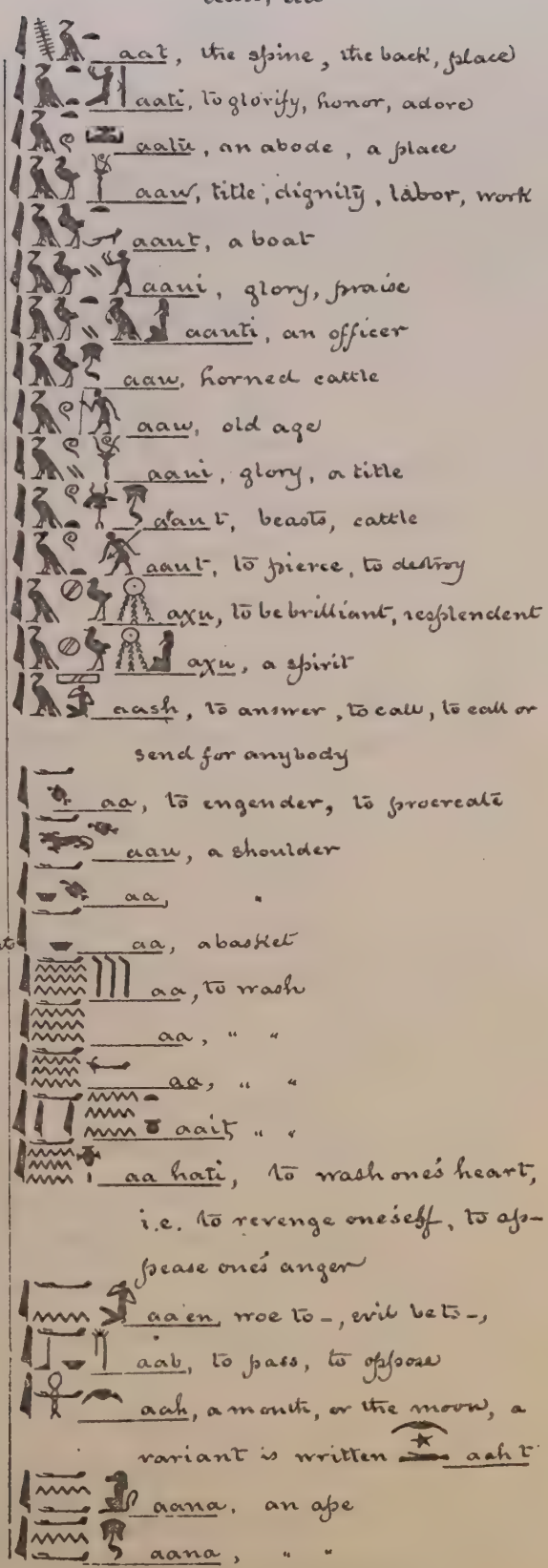
aarer, a rind

aanw, Elysium, the Necropolis

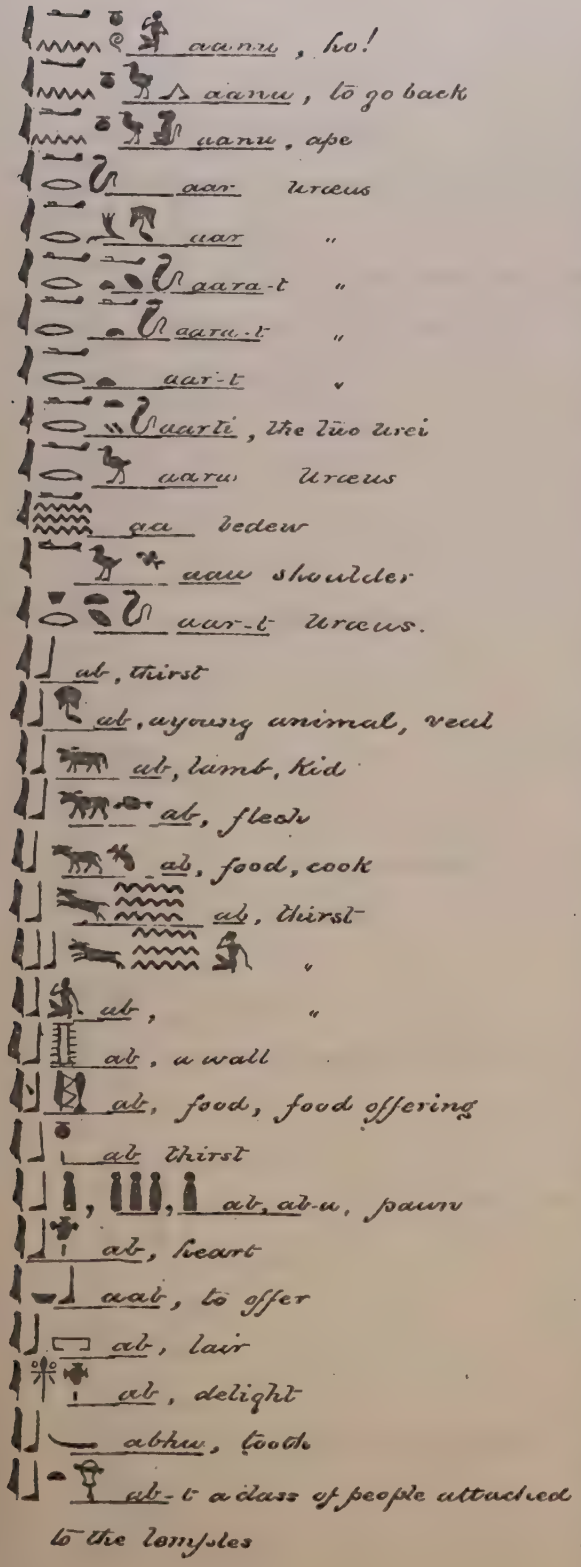
aat


aas, to travel over, to hasten
aaru, Elysium, a burial field
near Memphis
aaseb, leisure, chess
aas, go, haste
aat, a child
aat, leprous, pernicious, bad, evil
aat, to bedew
aat, deaf, to listen, to give ear to
aatut, a substance
aat t, the spine
aat t, unclean, a leper, convict
aatt, a net
aat t .
aagt, an orphan, destitute
auti, unclean, a leper, a convict
aat, a meadow, a pasturage
aatiu, "
aatcrek, a kind of goat, a herds
aauaa, a box, a coffer for sacred ornaments
aaut, a young bull
aat t, orphan, abandoned
aat, a moment
aa t, the back, the spine
aat, a house
aa t, old
aat, place
aat, "
aatet, a place, a house
aat, a place, a locality
aat, to separate, to carry off
aatiu, accursed, enemy, plague,
scourge, the Pastor race

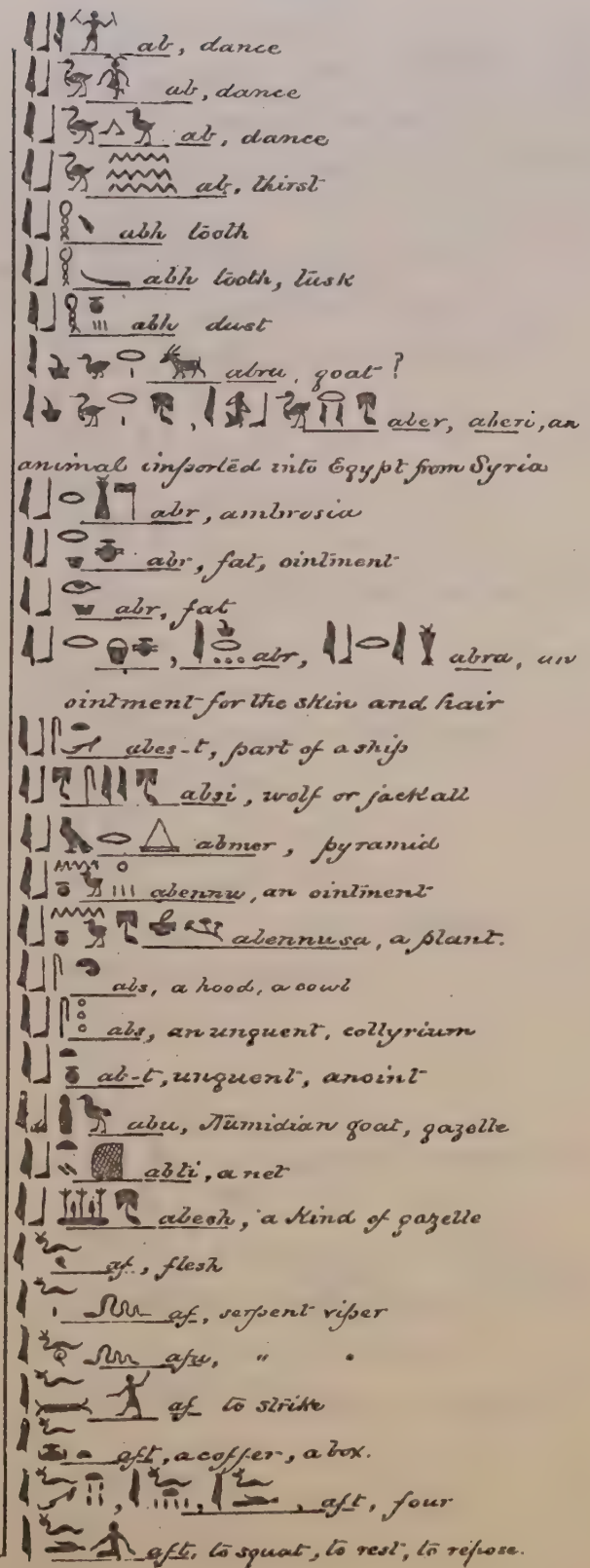
aau, aa


aat, the spine, the back, place
aati, to glorify, honor, adore
aatu, an abode, a place
aaw, title, dignity, labor, work
aaut, a boat
aani, glory, praise
aauti, an officer
aaw, horned cattle
aaw, old age
aani, glory, a title
aaut, beasts, cattle
aaut, to pierce, to destroy
axu, to be brilliant, resplendent
axu, a spirit
aash, to answer, to call, to call or
send for anybody
aa, to engender, to procreate
aau, a shoulder
aa, "
aa, a basket
aa, to wash
aa, " "
aa, " "
aait " "
aa hati, to wash one's heart,
i.e. to revenge oneself, to ap-
pease one's anger
aaen, woe to -, evil be to -,
aab, to pass, to oppose
aah, a month, or the moon, a
variant is written aaht
aana, an ape
aana, " "

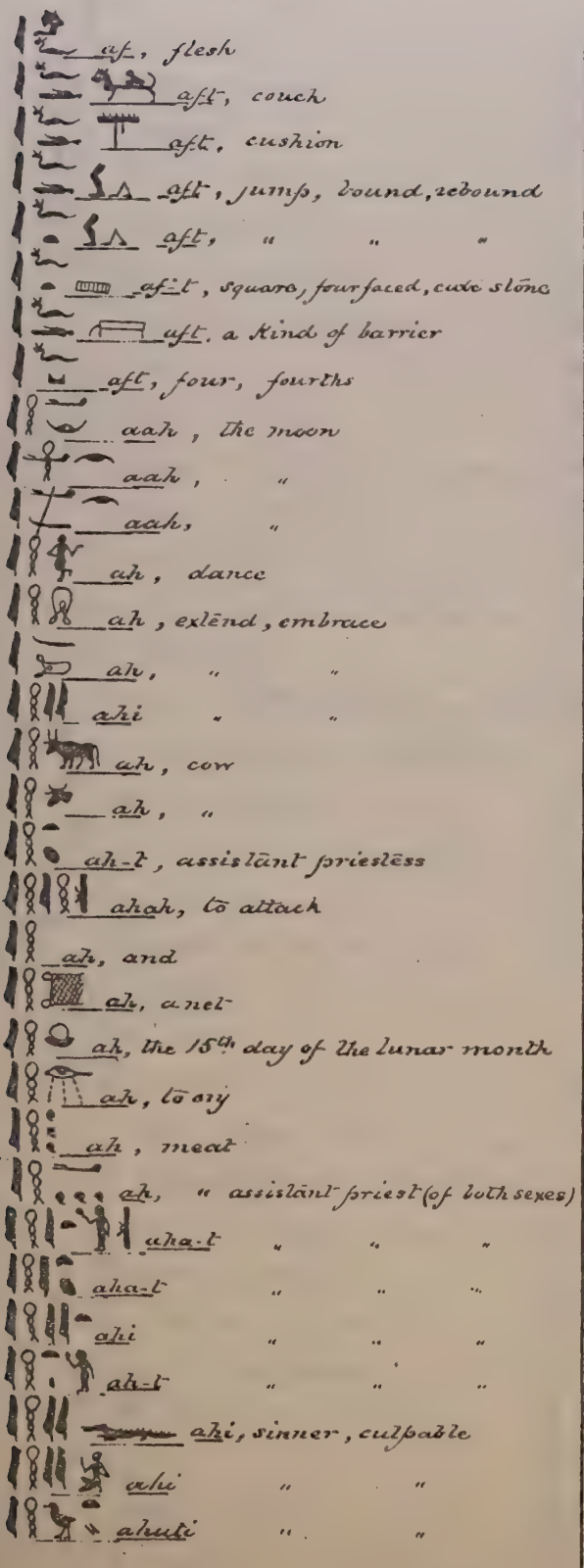
aar, ab


aanu, ho!
aanu, to go back
aanu, ape
aar. Uraeus
aar "
aara-t "
aaru-t "
aar-t "
aarti, the two Urei
aaru Uraeus
aa bedew
aau shoulder
aar-t Uraeus.
ab, thirst
ab, young animal, veal
ab, lamb, kid
ab, flesh
ab, food, cook
ab, thirst
"
ab, "
ab, a wall
ab, food, food offering
ab thirst
ab, ab-u, pain
ab, heart
aab, to offer
ab, lair
ab, delight
abhu, tooth
ab-t a class of people attached to the temples

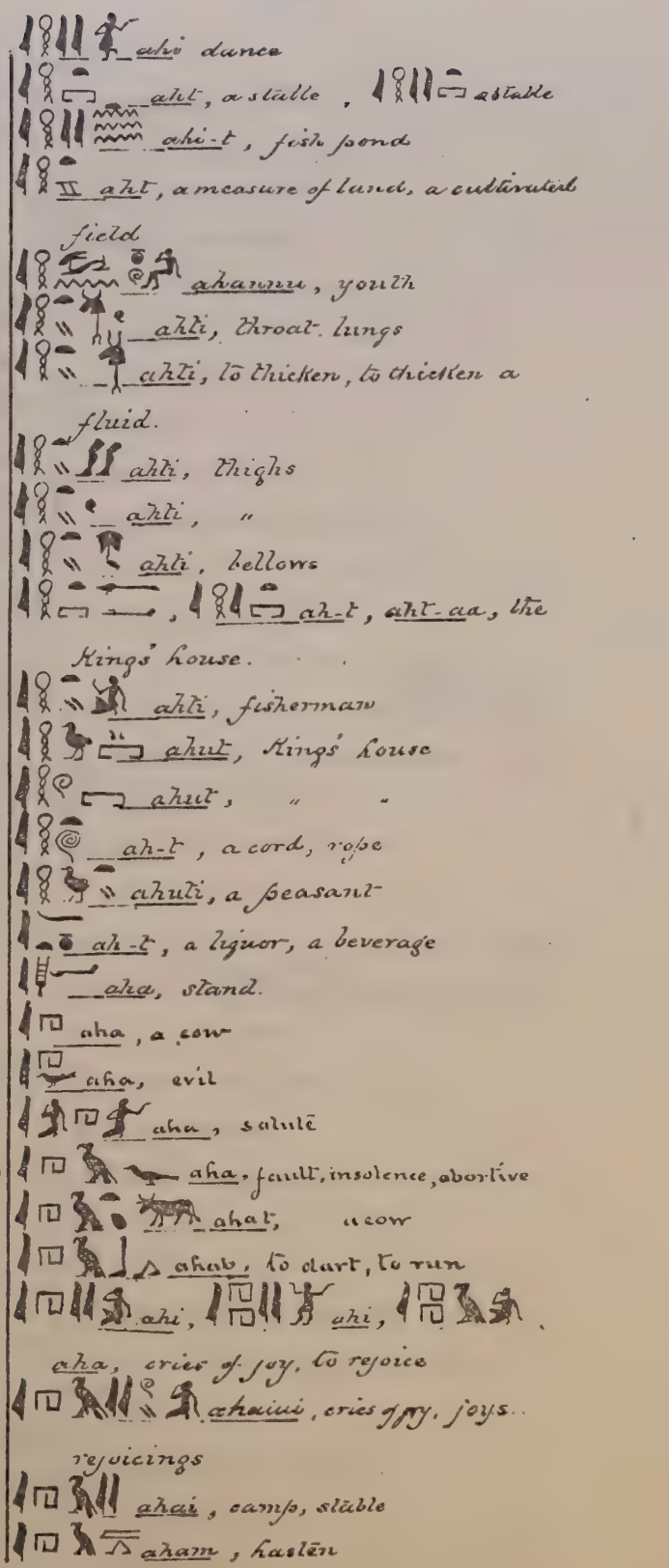
ab, af


ab, dance
ab, dance
ab, dance
ab, thirst
abh tooth
abh tooth, tusk
abh dust
abu, goat?
aber, aheri, an animal imported into Egypt from Syria
abr, ambrosia
abr, fat, ointment
abr, fat
abr, abra, an ointment for the skin and hair
abes-t, part of a ship
absi, wolf or jackall
abner, pyramid
abennu, an ointment
abennusa, a plant.
abs, a hood, a cowl
abs, an unguent, collyrium
ab-t, unguent, anoint
abu, Numidian goat, gazelle
abti, a net
abesh, a kind of gazelle
af, flesh
af, serpent viper
afu, "
af to strike
aft, a coffer, a box.
aft, four
afti, to squat, to rest, to repose.

af, ah


af, flesh
afṭ, couch
afṭ, cushion
afṭ, jumps, bound, rebound
afṭ, " " "
afṭ, square, four faced, cube stone
afṭ, a kind of barrier
afṭ, four, fourths
aah, the moon
aah, "
aah, "
ah, dance
ah, extend, embrace
ah, " "
ahi " "
ah, cow
ah, "
ah-ṭ, assistant priestess
ahah, to attack
ah, and
ah, a net
ah, the 15th day of the lunar month
ah, to cry
ah, meat
ah, " assistant priest (of both sexes)
uha-ṭ " " "
aha-ṭ " " "
ahi " " "
ah-ṭ " " "
ahi, sinner, culpable
ahi " "
ahuti " "

ah


ahi dance
aht, a stable, a stable
ahi-ṭ, fish pond
aht, a measure of land, a cultivated field
aḥamu, youth
ahti, throat, lungs
ahti, to thicken, to thicken a fluid.
ahti, thighs
ahti, "
ahti, bellows
, ah-ṭ, aht-aa, the Kings' house.
ahti, fisherman
ahut, Kings' house
ahut, " "
ah-ṭ, a cord, rope
ahuti, a peasant
ah-ṭ, a liquor, a beverage
aha, stand.
aha, a cow
aha, evil
aha, salute
aha, fault, insolence, abortive
ahat, a cow
ahab, to dart, to run
ahi, ahi,
aha, crier of joy, to rejoice
ahaiui, cries of joy, joys, rejoicings
ahai, camp, stable
aham, hasten

ahab, dance

ahab, incense

ahai, grain

ahhi, stand erect, rejoice

ahi, rejoice, joy

ahi, rejoice, joy

ahi ru, a military post

ahem, incense

ahem, to respond

ahem to contradict, anguish

ahem perfume

ah-t, cow

ah ur grief, pain, great suffering

ai, ah! Oh!

ai, to come, ai ekua, I come to thee

ai, interrogative form, assuredly, certainly,

ais, a sepulchre

ak, a superior, a learned man

ak, to twist

akel to lament, to cry

akel " "

akelu " "

akelu " "

akel, a name of the inundation

akel nu, waters of the inundation

akel, to bow, bend, incline

akap, to destroy

akem, a shield

ak-t, to suffocate

akebu, the fresh evening breeze

aken-t, a garden, a retreat

akennu, to salute, congratu-

late, address.

akn, to adore

aken, vase, cup

akesp, cloud

aku workman

akt, to suffocate

aqueh, to go, enter, hasten

aquehu, to go, enter hasten

aquehu, " " "

aqw, lost

aqu, skilled workman

aqu-w, skilled workmen

aquem, shield

aquer, adept, skill, skilled, divine

aquer, clever prepared; = em hennu aquer, a perfect child, infa-

aqu, fire flame

aqhu, " "

aquer, a plant

aquer, quick, sharp, perfect, accomplished. altogether: em nu aquer, very well, perfectly well.

agera, bolt, bar,

ag-t, a liquor

aquerti very much

aka, quiet, subdued

akel nu, waters of the inundation

akebu; the fresh evening breeze

akeb, to bow, bend, incline, subdued

akeb " " " "

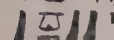
aki-t loss, injury

aki-t, " "

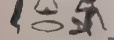
akap loss, veil

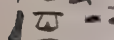
akap, cloud.

akepi, loss, injury


aker, silence, charnu

aker-t, Hades, the lower regions


akana, a goblet, amphora


akalu, workmen

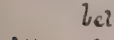
am, in, among, there, amid, where, belonging to, by, with, from, in it,

am, to roar

am, date tree, pleasant, agreeable giving relief; the variants are –

am nen, no, do not

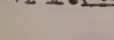
am, shine, radiant, resplendent

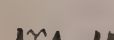

ami " " "

amim " " "

amma, to give, accord, allow, if,

amma so that, may (he prosper)


amma, find, may,


amma, give, may. marks the imperative. amma sma, be in good health, fare well.

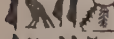
ammatu soleru, let (him) be notified

am, seize, grasp.

ams, a stick, a badge of authority

amt-t, a kind of vine

amtu, belonging to


amax, to bless, mature

amax nen, to ignore, not to be, not to know, unable

am, to eat, among, belong, in, amid, there

am, a variant of the above; where

am, a cloak

am-t, point

am, a dress or part of a dress

ambahu, ancestors

am, pavillion, tent

am-t, splendor, light

amu, to desire, to urge

am, a kind of tree

ama, a kind of tree, a date tree, pleasant, agreeable, giving relief

amax, bless, devoted, mature,

amax, one who performs an act of veneration or is venerated

amaxi, " " "

amax, the blesser or the blessed

amaxu " " "

amaxi " " "

amaxi " " "

am, as

am, find

am, milk, the udder of a gazelle

am give, find

amam, urge

amem, many

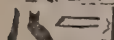
amema, give, accord, allow, if, so that

amemu, light, sparkle, resplendent

amem, dirt, mud

amemu, skin, hide

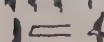
ammeh-t, chapel, tabernacle


ammehu-t " " doorway

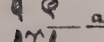
amem-t ha-t, the place of exit from the abode of the dead, whence the soul sprang to the heavens

am,

ami hati, pure hearted, innocent


amt, a favorite, a pet

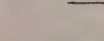
amu, among, in, amid


am, date tree, agreeable, pleasant

am ha-t chapel, tabernacle

amen, hide, conceal, envelop, mysterious, hidden

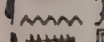
amen hati, hidden-hearted, hypocrite, rogue, false hearted, deceitful

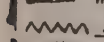

amen, to hide, conceal

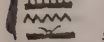
amen, hide, conceal, envelop, mystery

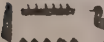
amen, to hide, conceal

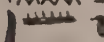
amenu, a secret place


amenu " "


ameni, offerings, rites

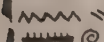

amenti, hide, conceal

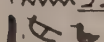

amenu, to come, to accost

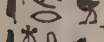

ameru, to sustain injury, to perish

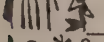
ames, pretense, fiction, feint

ames " " "

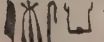

amesKau, skin, hide, leather

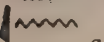
an, by, is it not, is the index of the nominative case, (speech) of; Variants ,  , if.

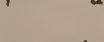

anru, a stone

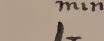

an, a wheelstone

an ru, gate, door

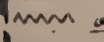

ana, an ibex


anbu, a wall

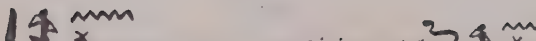

anib, to rejoice


anku, to squeeze

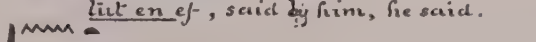
aneq, I (the King)

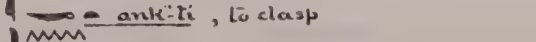

aneq, to clasp.

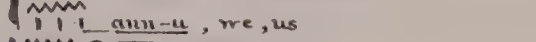
an

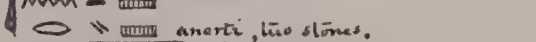

a en ef, an elision of

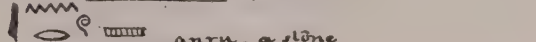
liut en ef, said by him, he said.

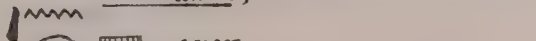

ankti, to clasp


ann-u, we, us

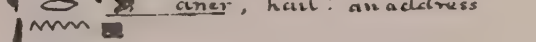

anerti, two stones.


anru, a stone

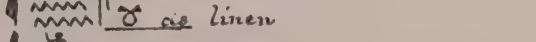

aner, "

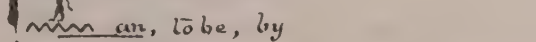

aner, hail! an address

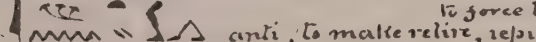
anerp, orb

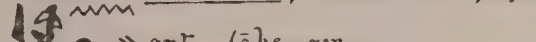

as linen

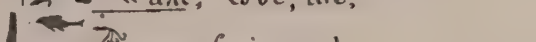
an, to be, by

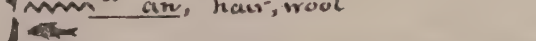

anti, to make retire, repulse, to force back


ant, to be, are,

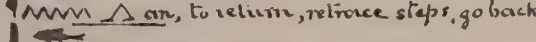

an, hair, wool


an, to return, retrace steps, go backwards

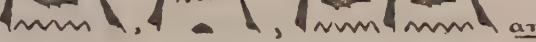

an, wanton, to suffer


an, anan

destroy, cut, the name of all implements of destruction


, , anti, an, mountainous country, mountain, valley

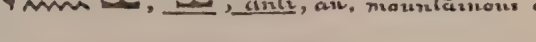
ani, ana, anti, branch, clump of trees, grove

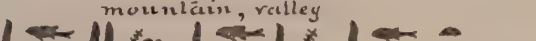

aneb, a wall

anbu, a medical substance

anbi, cornice, wall, precinct

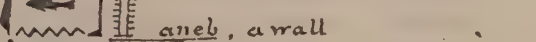
anebi, to encircle, to surround

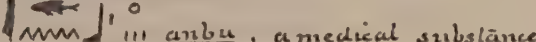

aneh, surround, garnish, wrap


anhet, to draw wine, a beer jug

anh, eyebrow

anhu, to ride


anehu, to surround, garnish, wrap


ani, a clump of trees, a grove

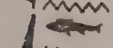
an, as

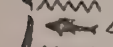
aneq, to embrace, clasp, join, reunite

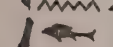
anek, a plant

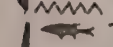
anem, hide, wool, skin

anem, hair, wool

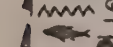

anemti a vase

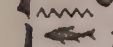

anmemti "

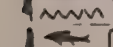

ans, linen, fine stuff


annu, beauty

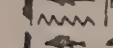
annui, sandals

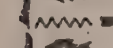

ans, linen

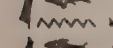

ans, linen

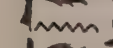

ans, linen

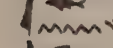
an-t, repulse, afflict

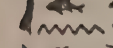

ant, valley, hill

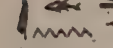

an-t " "


anti, go back, turn back

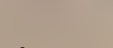

" " or " "


ant, afflict, sad


antesh, a venomous animal, a scorpion


anushana, cane

ap, head

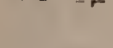

ap, bushel

up, a liquid, a liquid measure or quantity

ap, to take account reckon, fit, proper; judgment

ap-u, these, those

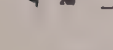
ap, stairs


apa, reckon, calculate

apap, a slab of stone

ap

apeh, boar, pig


apeh, steel

api, hippopotamus

api, number

apek, desolation

apen, this

apslen "

apen "

ap, a liquid

apr (apf) wine

apt, hippopotamus

ap-t "

ap-t judgment

apt, a duck

ap-t "

ap-t "

ap-t number

apt, a stick, a measure of length, a plant

ap-t, a little house, a manger, a quarter of *Thebes*

ap-t, bread

ap-t, a name of *Thebes*

ap-t, a sanctuary, a chapel

ap-t, a measure, 18.20 litres

ap-t a plant

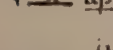
ap, guide, lead, guage

ap-t, guide

apti, guide, lead, propose

apt, some part of a door

apt, a dry measure


upt, " "

apnu-t, a metal

ar

apu, a title deed

ar, are, it is, (before a verb- if) to, let do, because, when; with or without it shews that the word is bound to what follows, ex: xer ar hru, (when) after some days: ar em. nax-t, when, whilst, afterwards

ar-u, to be

ar, keep, guard

ar guard

ar, arourα, acre, 608 3/4 cubits of 606 3/4 feet

ar, to point

aref, this is good, or forsooth, indeed

ari, guard

ari, guardian, companion

ari tut sen-u, finger ring

arui, adversary, enemy.

ari-t uai, The guardian of the boat, the padrona

arumau, with, between

arumau " "

arri-t, store house

arni, is applied to a blow pipe

arp, flower, grape

arp, vine, wine

or arp, wine

arr, deaf

arr, vine

arr, grapes

arr, form, ceremony

or art, milk

art-t milk

ar

ar-t bracelet

ar-t anklets

arti, milk

aru, to undress, disrobe, strip

arlu, a garment

aru, lurns, companions

aru, a river, a water course

aru, rump

arulef, repose

ar-t xex, a collar, a necklace, neck chains

, , , ar, aru, ar; that which is to be done, rite, ceremony

ara, some substance

arr, " "

arr vine

ar, a man, someone, somebody

ar, the Ptolemaic epoch

ar garment

ari, a blade, a cutting instrument

arlu, garment

arlu, deeds, forms

arnt milk

arp, wine

art-t, milk

ar sep sen, twice made

arru, ceremony

arrui, transformation, incarnation, rite

ar, ceremony

to be so

aren, that which is handsome or appears

uren, to return, to retrace the steps

" to go backwards " "

arenti " " " "

as, behold, when, noble, also, moreover, voila, voici, now then, also

as, great, noble

as, lo! hail!

as, a chamber

as, a sacrifice

as, to go, to transport, aslit transport of a statue

as, hasté

as, noble

asa, great

as-t, a rag, a tatter

as, a tomb. per asiu, house of forefathers, tomb

as-t "

as, a beam

as-t, the laboratory of a temple

asat, a period of time

asau-t, a beam

aseb, a throne

aseb, "

aseb-t "

aseb-t "

usebarr, a whip

aseb parru, woods, forest, grove

aseb nunu, a plant, a hoe

aseft, idleness asef, bread

asef-t, idleness, fault

asehu, stuff to wrap on, pad, a slip

asi, vile, culpable, pernicious, injury

asiu, vileness

asi, to gain, obtain

asef, to soil, infect, violate, profane, v.

asfi } expresses moral iniquity
asef } in contradistinctions

ma-t, truth, re

asek, then! lo! behold! voila

anteroom

asequeb } waiting room, antichamber, to wait, to stay

aseqbi, to weaken, delay

asequ-t, to delay, retard

asi, vile, contemptible, culpable, felonious, injury

asti " " "

asmer, a precious stone, emerald

asmer " " "

aseft, a throne asru, slab

aseft, a sledge asru, stands

asebarr, a whip of form,

asbu, a book, text

aspalla, a quiver,

aser, tamarind tree

asser " "

aser " "

asru, ripe tamarind

asen, to salute, to prostrate

asni, to respire

as " "

assex, hurtful

asennu, book, text

astet, tremble, wonder

astet, prisoner, tremble

asennu, book, writing

ast, and, also, moreover; thus, see, now then, behold and particles of

exclamatory kind.

ast, commences phrases; governs the past.

as-t, a rope

ast. a seat, a throne

aslu, and, also, moreover, thus, see, now then, behold &c

asui, a tomb

asu, price, tax

asu, recompense

asu-t, testicles

asua, seat, throne

asuau-t, a beam

asuata, "

asex, sickle, mow,

asex, mow

asxenu, to proceed

as sheni-t, headman of the people, chef d'arondissement

asef-t idleness, fault

asu, transformation, incarnation

ases-t, ground, floor, soil

as, a chamber

as, go, proceed, depart

as, food

as, rest, repose

asha, corner

asef-t, idleness, fault.

aslel, tremble, flutter

aslel-t, a draught

at, deaf- , at, child, descendant

at, destitute

at, deficient, dew

atah, a kind of food, an offering

alex-t, a reed, papyrus

aleb, a wall, the shore

aleh, reed, papyrus

alma, a kind of linen, tissue, bag

alina " " " "

alen, disk

alen t ?

alen t ?

alen, chief, director, commander

alen " "

alent, to cut, pierce

alenu, disk

alep, to load

aler, the heart

atlusa

at-t, retribution

at-t, ?

at-t, a net

at-t, a store house, depository

alu, deficient, destitute

alu " "

alex, a reed

alu, listen

alu, deficient, destitute

alex, to trample, to knock down

at-u, year

alen - to reckon, to create

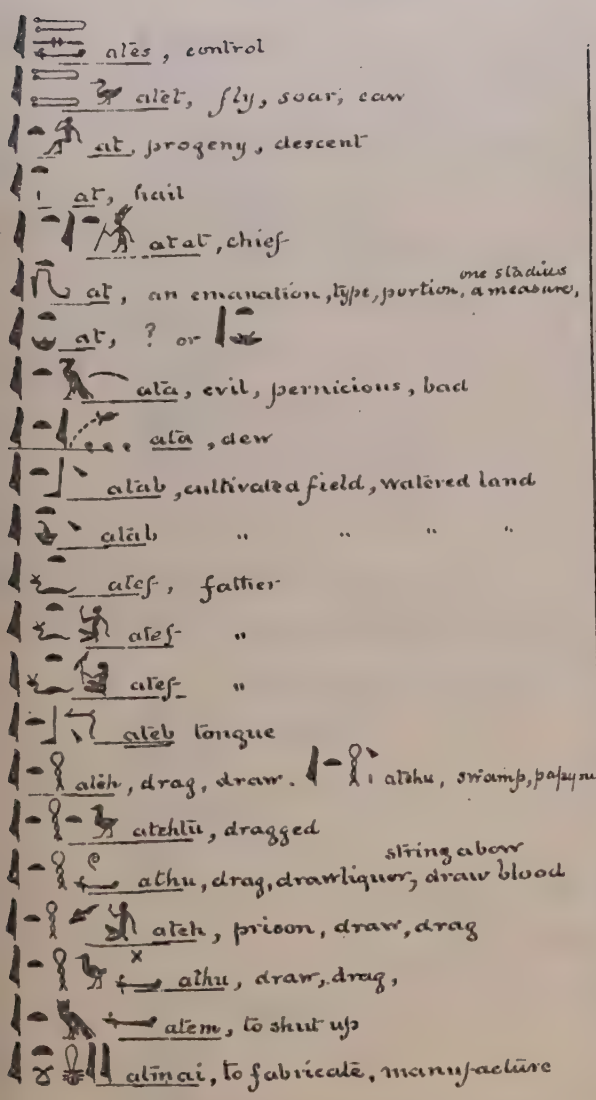
alen, to strike, beat

alen, solar disk

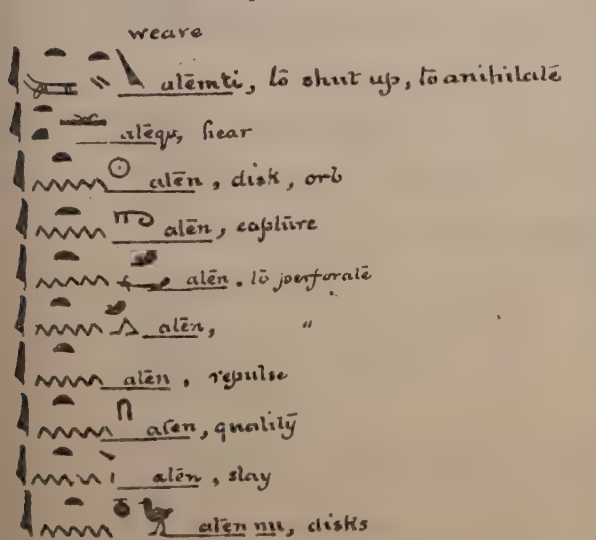
alennu, to take form of a disk

ales, quiet, control

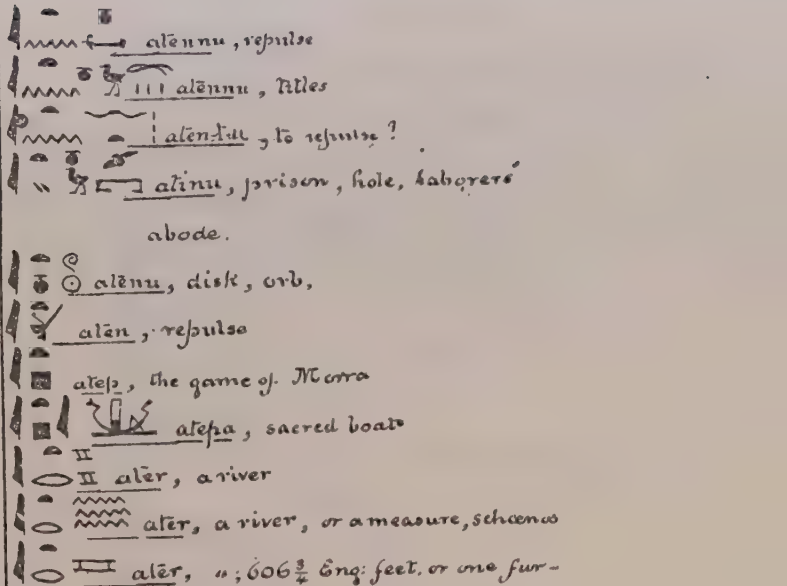
ar



weave



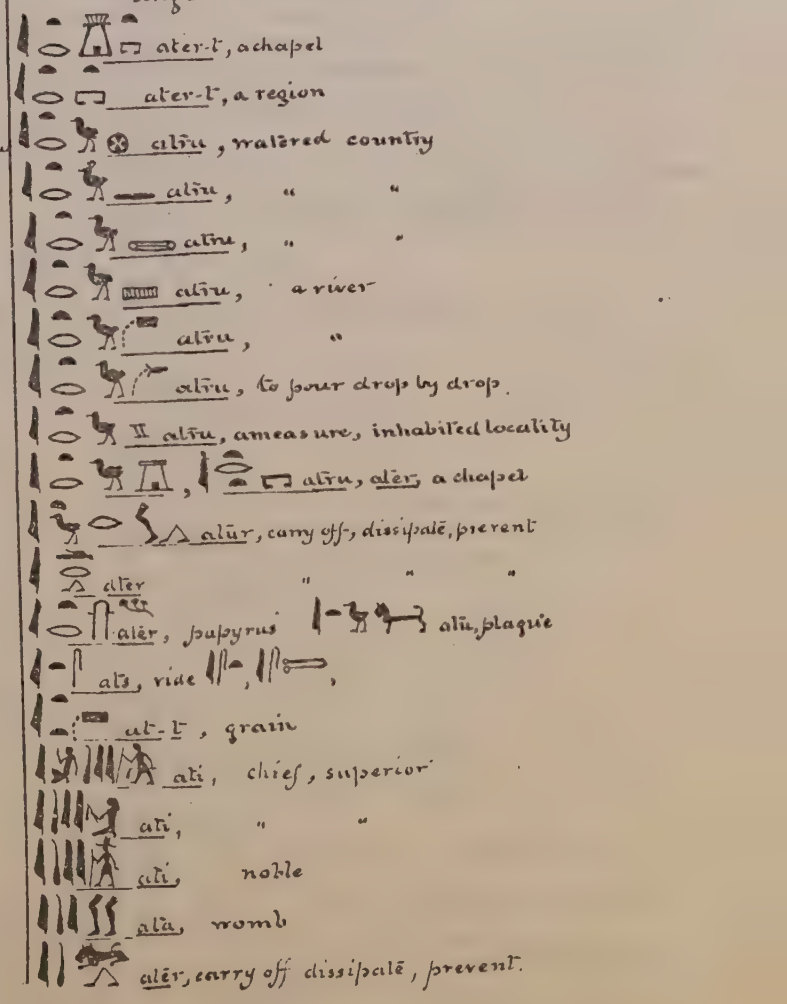
at



abode.

alēnu, disk, orb,
alēn , repulse
alēp , the game of Mora
alepa , sacred boat
II alēr, a river
alēr, a river, or a measure, schœnus
alēr, " ; 606¾ Eng: feet. or one fur-

long-



at, au

ata, steal, run off

atau, thief, rob

atai, carry off, steal, take possession

ati " " " possession

atāru fantastic, shame

atī, limit, space

atī, " "

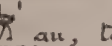
atera-t, house

ater, to speak

at, image, form

at, color

atu, to reveal oneself

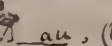
au, to be; 
au rex ek

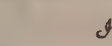
nu, I know that thou--

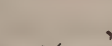
au, elder

au, flesh

au, cow

au, (to be) was, is, &c. 
au-tu a

I have been, 
, au ef, he is,

who is.. 
you will make.

au-u, cows

au, dignity

au, to train, break in, chastise,

submission

au, shoulder

auai a substance

auf, to train, break in, chastise, sub-

mission

auf, flesh, muscle

auker, Hades

auteh

au mes, it being supposed that

aut, a place

au, ax

arāru, fantastic, shame

auiu, light, splendor

aumax, to bless, mature

auhemu, indestructible

auxu, diadem

au, was

auf, flesh, muscle

aui, glory

aur, river, the vulgar name of

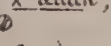
the Nile

au, bull, steer,

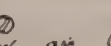
au en ru, beef, an ox.

auah, monument

ax, an exclamation, let, yes!


ax rex ek su- yes! remember it

ax, how! how great, how much, who then,

now then, 
how are you?

ax, turn

ax, spirit, title, what? what now

axa, elevate, superior

axa, praise, glorify, exalt

axi, what?

axi, elevate, axpeter, a name of Amen-ra

axi, praise glorify, exalt

axem, enemy, criminal,

axemu, not, never

aximu, stellar Gods

axer, building material,

axer, cows, victims

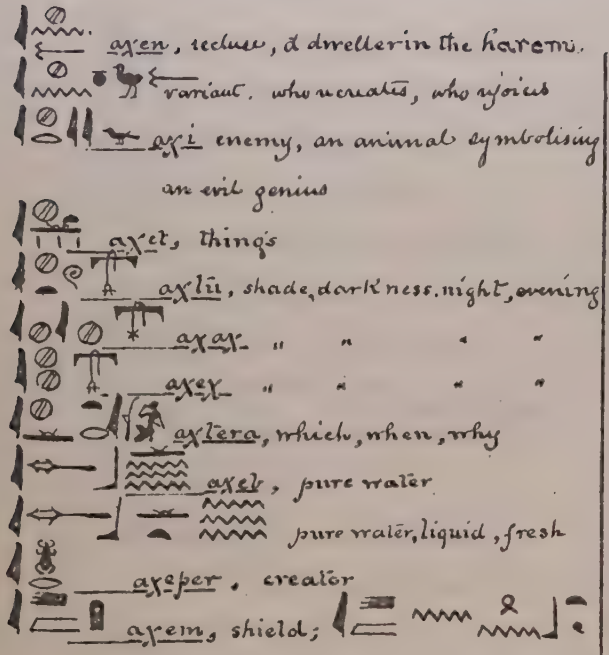
axer, to overwhelm, to afflict, to

variant. crush: a term denoting the

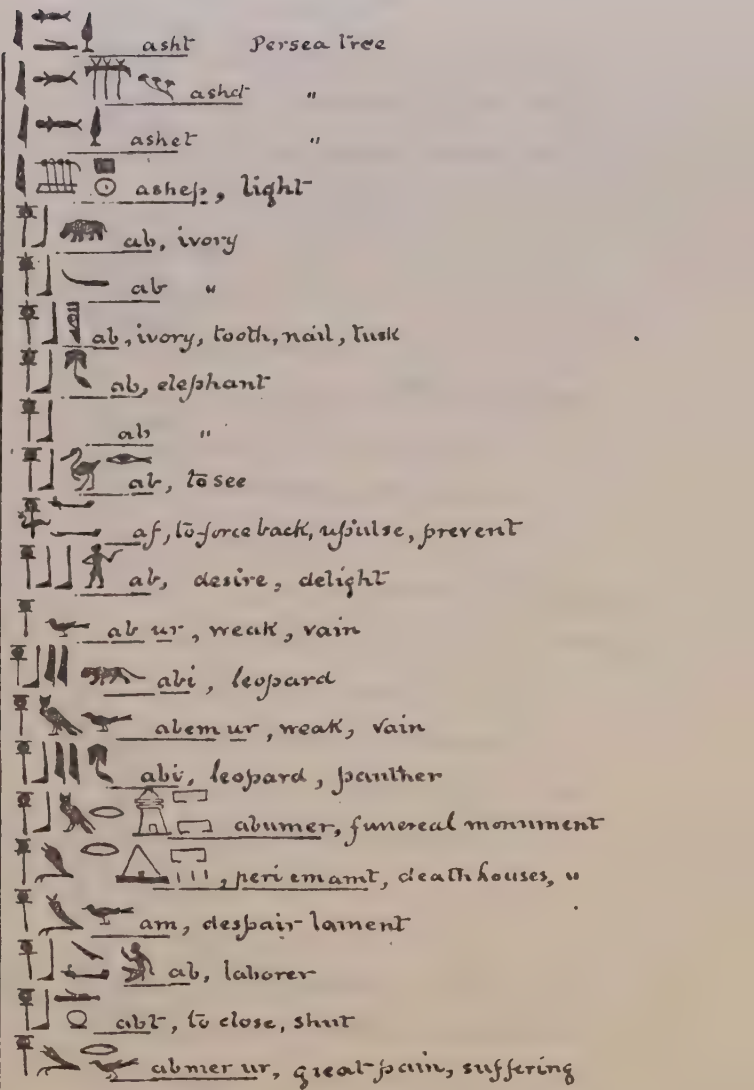
materials with which grounds are

enclosed.

ax, ash


axen, recluse, a dweller in the harem.
variant. who mutilates, who injures
axi enemy, an animal symbolising
an evil genius
axet, things
axlū, shade, darkness, night, evening
axax " " " "
axex " " " "
axtera, which, when, why
axek, pure water
pure water, liquid, fresh
axeper, creator
axem, shield;
axem en shenb-t, shield of the knee.
a shield used kneeling.
, darkness, night
ash, to emit, to pour, to flow
ash, things, goods, titles
ash, figs of Persea
ushemu, come,
ashemi, imperative - go!
asheṣ, grapes
asher, broiled meat
asher, a river, the Nile
asht, a Persea tree, the tree of life,
a fruit tree, may be an apricot tree
asht, Persea tree
asht, Persea fruit
ash-t, things, goods, titles
ashesh, to carry, transport
ashesh " "
ashaṣi ur, ruin, consume,
destroy

ash, ab


asht Persea tree
ashet "
ashet "
asheṣ, light
ab, ivory
ab "
ab, ivory, tooth, nail, tusk
ab, elephant
ab "
ab, to see
af, to force back, repulse, prevent
ab, desire, delight
ab ur, weak, vain
abi, leopard
abem ur, weak, vain
abi, leopard, panther
abumer, funereal monument
, peri emant, death houses, "
am, despair lament
ab, laborer
abt, to close, shut
abmer ur, great pain, suffering
or evil.
abu, feast, cookery
abex, leap, penetrate
abexu, penetrate, move
abex, to penetrate
ab, laborer
abi, leopard, panther
abti, the East
abu, elephant
ab, wish, desire
ab, move, brandish, dance var:

ab.

ab, move, brandish, dance

ab. destroy, consume

abb, wish, favor

ab. passage, frontage

abt, the East, the left hand,

abt, abode

abti, work, sharpen

abtit. fish

abti, fisherman

ab, moon

ab, to go, depart, leave

nen ab. perpetually without ceasing.

abeb, to love, desire, want

abti, the east wind

ab, the East

ab, on the Eastern, on the left hand

ab, the left hand

ab, a panther

aber, an ointment for the hair and skin.

aber. (var.) " "

abti, an abode

abtu, a kind of fish

abtu, a form, a likeness

abu, fire, to warm, to excite, to dip, to soak, to exercise, raise, set up, prepare.

abu, to love, to desire, to want

abu, to go, depart, to leave

abui, a form, a likeness

ab " "

abu-t " "

ab, am

abex, to penetrate, move, leap.

abex, to penetrate, to move, to wish

abex, to penetrate, to extend oneself, to develop, to unite to.

abex, " "

abex, " "

ab, to dance

ab, pied, variegated; ab, a passage

ab shu, variegated plume

sti, to dart rays, to light; radiant

am, in, among, there, by, amid, pleasant, grateful, pleasing: am hati kind hearted; am tut, pleasant hand, i.e. liberal; a favorite

amam, to saunter, to wander

am, shine, to be radiant, to glitter

am-t, women's tent, a camp.

am, a tent

amer, corn

amuteh, a title

amuu, to stretch, to measure

am ur, great pleasure.

am, in, belonging to

am, in, belonging to, among.

am, eat, devour, am hati, to be discreet, to dissimulate, (to eat one's heart)

am, eat

ami-t, devouring flame

amha, patent, title, deed

ami, inhabitant

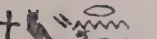
amta, a kind of bread, food

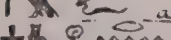
amu-u xat, intestines

amu, eaten, devoured

am-aat, a class of priests

am, an


anti ren ef, a catalogue


amu ren ef, "

ami, in, belonging to

ami hat, porch, entrance

amu-u shenti per, the peoplereside in the house, the officers of the palace.

am, belonging to, in.

amlā, bread, food

amtehu, a kind of bread

amtuu, caste, rank

amamut-u " "

am uri, eyes royal, title of an office

a class of priests

am ur, the cemetery

ami ur-t, a liquid

am urt, the eastern side of a building

am pertait, a title deed

au, a column;
an, evil

an, a ram, a catapult

an, a column erected on the burial places of strangers, a heap of slain enemies.

varianti " "

an, iniquity

an, hail! rejoice;
af, a shrine

anti, plain

anti, brought, men of the gate.

an-t, evil, iniquity, injustice

anharu-mai, a bunch of grapes

anherumai "

anrumai " "

anu-ru, vases for the fruit

an, asp

an-ut-xu, precious stone

an mut, High Priest

an mut-ef " "

an mut-es " "

anqu-sqa-ef, some part of a chariot.

anuru, vases

anuruna, oak tree

anti, a bow

apt or tep. head, begin, commencement, point, chief, prince

apitehen, forehead

apiret, dedication;
apiret texen-u, dedication of obelisks

api, forthwith, proceed

api nu, the essence of a human being, spirit

asp ru, the mouth

asp ru, edge of the lip, palate

asp nu, an oral communication

asp ru neu, a prayer, a hymn

asp ret, rule, prescription, law

asp menenu, head of the road

asp shu, ruin, origin

apsi, an ointment, an oil,

asp nu per-kait, chief of library

asra, ancestor

asp kat, first

asra nechr, ancestor of God

asp-t, a measure of Litres 0.151

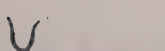
asp-t, the head

aspt nu, the edge of the lip.

asp an extent of land, a swamp

aṗ

aṗ. commencement


aṗ, forehead

aṗ-t, declare, expose, distinguish, judge

aṗ, to contend, debate

aṗ, aṗu, aṗ, declare expose, manifest, to shew oneself, distinguish, judge, order, control

aṗ, to judge, to compare

aṗ, to move

aṗ-renṗit, commencement of the year

aṗ aani, cynocephalus

aṗ, rejoice

aṗma dream, sleep

api to judge, to determine, to distinguish

aṗ, equal ?

aṗ-ru, the ceremony of opening the mummy's mouth in Amenti

hebs aṗ ruṗer-u sbau, the feast of the opening of the temple gates; extra mural procession

aṗ ru, a fillet consecration

aṗ ru "

aṗ ru, " proof, consecration

aṗeṣ, to open

aṗs, supine

aṗs, heat

aṗs total, the number

aṗs, to prostrate oneself on the ground

aṗ-t, to suckle or raise a child from infancy.

aṗ ta, the horn of the world, the world's end.

aṗ-t, commission, commissioner

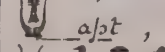
as

aṗ, corner, extremity

aṗt, impart

aṗut, work, an undertaking

aṗtu-ru consecration of offerings


aṗ, aṗu, aṗti herald, guide,

aṗu, conduct, send on a message ambassador, guide, police.

aṗu, excess

aṗsh, hate, float

as, ancestor

as, a statue

as, noble, great

as-t, a favorite

ases, to embellish, to honor, to esteem

ast, noble, great,

as, noble, great, great gifts.

as-t, noble, great

asu, venerable

as, noble

ari, guard, keep, companion

ari " " "

asau, to watch, guardian, care for

asau, to break, smash

as, noble

ari, blade, cutting instruments, sword

arti, aman, somebody

asui, asu, recompense

asu-t, the temple's laboratory

ari at en ursh, Guardian of the Observatory

as, a chamber

asi-t, the laboratory of a temple

as, ab

as-t, an ounce

asti, a servant, a satellite

ast, place, situation

ast-u, columns

ast ru, to depend upon, (to be under the order of her ast ru)

ast hati, the place of the heart, the bottom of the heart, heartily

as-t ur-t the great place, the Sanctuary.

as enti amenlu, funeral chapel.

asi, august, venerable

ast nefer, beautiful place, tomb

Ka, a bull

ab, contrary, opposed to well being

ab, " " " " "

ab, " " " " "

ab, " " " " "

sefex. capsize, topsy-turvey

am, illustrious

åmm "

amm "

amm, beholders, mankind

ajpu light

ajpu light, spirit

amm, beholders, mankind, spirits of the earth adoring Ra.

amm, beholders, mankind

lut, hand, Kab, arm

lut, direction; as, charged with the direction of the temples — of the army's marsh: condition of health,

a

as, 'tell me of thy condition' i.e. how thou art. Blows, as, nen nehem ef lut, not repeat he blow, he did not need to repeat the blow.

a, shoulder

ab, to wash

ab, "

tutmek, on the northern hand

lut sesh, on the southern hand

a, a jar

a, a basket

a, a cover, lid

à, a 26 cubic measure

ua, one, 1 the hand or arm is also a determinative of works of the arm, in 'fight-battle &c'. aet, active, make gestures; ex. lut u sen they made gestures.

a, moon; Kah, a corner, an angle

a, to go

aa, to sleep

aa, a pyramid or tomb

aa, an obelisk or tomb

aa, great, much

aaia, " "

aaai, " "

aa, " "

aa, to knit

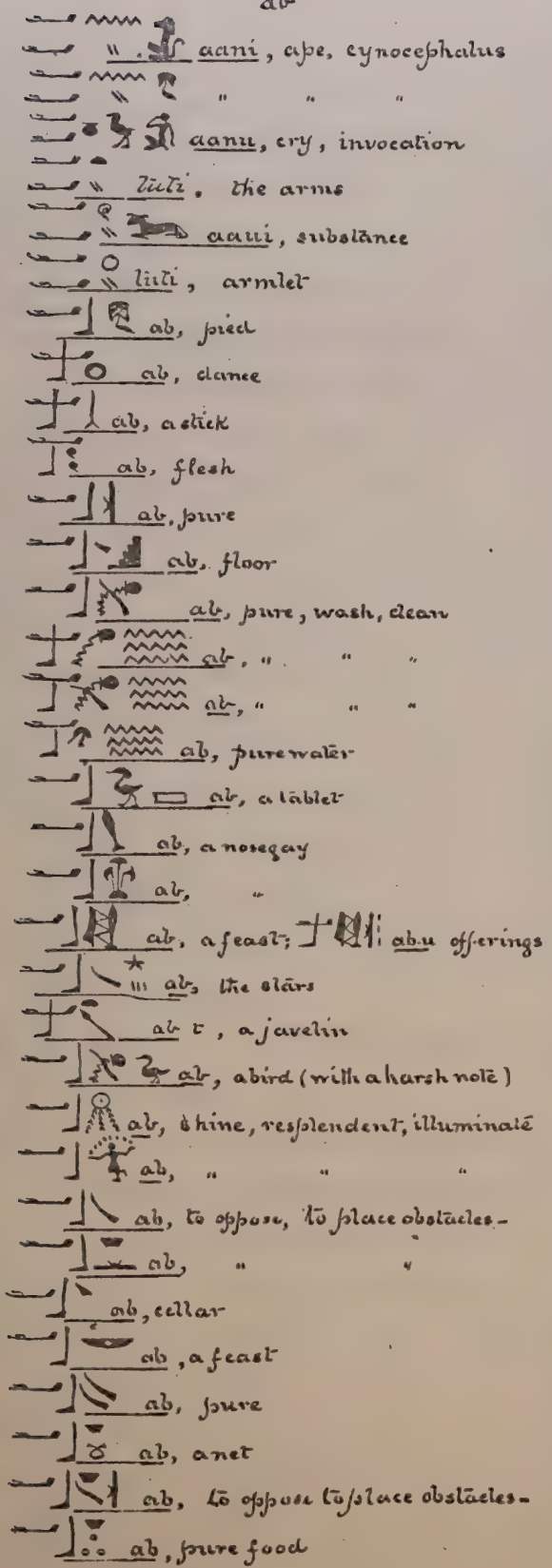
aa, substance, issue

aa, " "

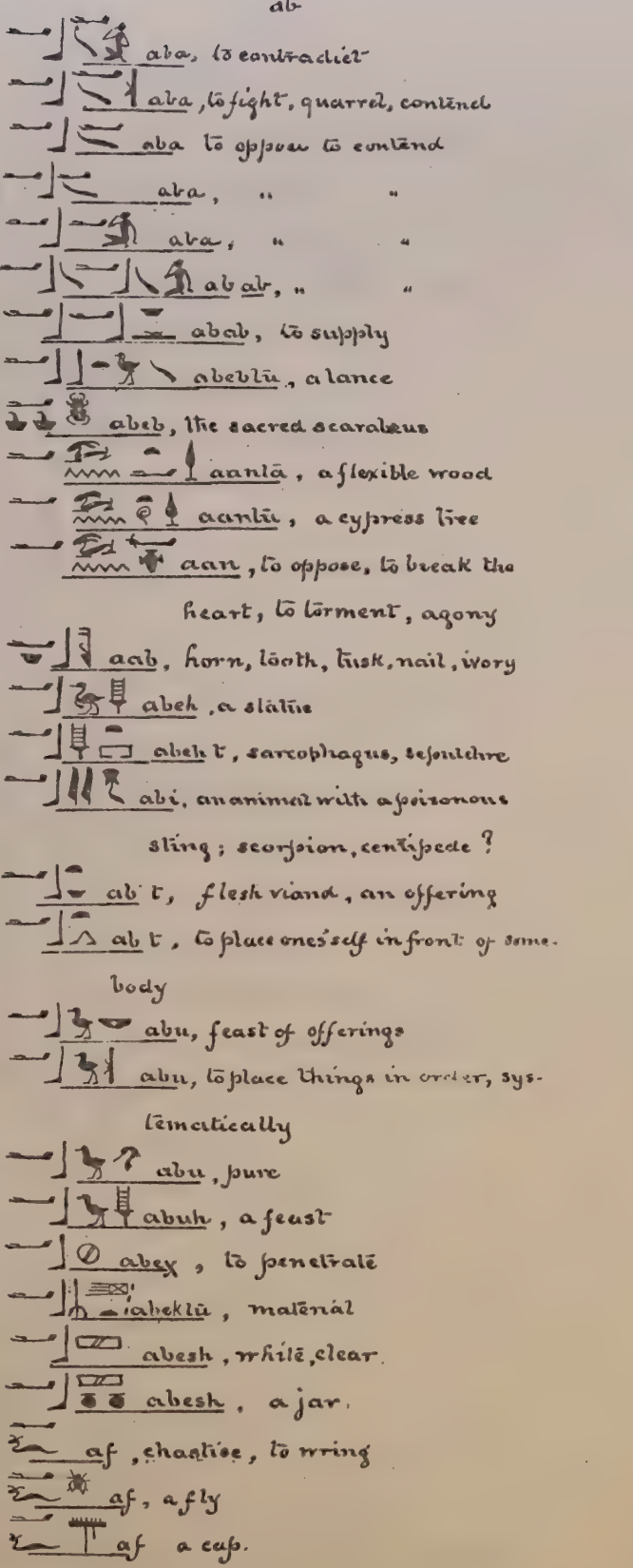
aani, ape

aani a lent

ab


aani, ape, cynocephalus
" " "
aanu, cry, invocation
Zuti, the arms
aaui, substance
liti, armlet
ab, priest
ab, dance
ab, a stick
ab, flesh
ab, pure
ab, floor
ab, pure, wash, clean
ab, " " "
ab, " " "
ab, pure water
ab, a tablet
ab, a nosegay
ab, "
ab, a feast; abu offerings
ab, the stars
ab t, a javelin
ab, a bird (with a harsh note)
ab, shine, resplendent, illuminate
ab, " " "
ab, to oppose, to place obstacles
ab, " "
ab, cellar
ab, a feast
ab, pure
ab, a net
ab, to oppose to place obstacles
ab, pure food

ab


aba, to contradict
aba, to fight, quarrel, contend
aba to oppose to contend
aba, " "
aba, " "
ab ab, " "
abab, to supply
abeblu, a lance
abeb, the sacred scarabaeus
aanla, a flexible wood
aanlu, a cypress tree
aan, to oppose, to break the heart, to torment, agony
aab, horn, tooth, tusk, nail, ivory
abeh, a statue
abeh t, sarcophagus, sepulchre
abi, an animal with a poisonous sting; scorpion, centipede ?
ab t, flesh viand, an offering
ab t, to place one's self in front of some body
abu, feast of offerings
abu, to place things in order, systematically
abu, pure
abuh, a feast
abex, to penetrate
abeklu, material
abesh, white, clear
abesh, a jar
af, chastise, to wring
af, a fly
af a cup.

as, ak

afa, a lettuce

afa, meat, flesh

af-ef, a head dress of honor

afent, wig, band

afent " " cap

af-ni, wig, band

afennu, to be covered, to be blindfolded, hooded

aft, abode, couch

afti, cover, lid, board

aft, box, coffin

aft, " "

aft, abode, tomb

af af crocodile

ah, a house

ahebt, a bird

aha, to stand

aha, attendant

aha, a field

ai, a stream

aii, raise up

aq or ak, to enter, to proceed

ak, bread

ak, to enter; the middle of a thing, principally the human system; being in the middle, to place in the middle, to dispose of equably.

ak, a rope, a cable

ak, the jaw

ak, centre

ak, enter, proceed,

ak, a finger

ak, a cover, midst

ak

ak, to go

aka, to twist

akaa, the middle, just, regular

akai, the spoon

aka, twist, cable

aka, rope, rigging

akau, equilibrium

aki, favor

akem, wrapped up

akusu, entrances

aku, bread

akeru, a grain measure

aka, grain

aka, "

aka, heat, dried up with heat

aka, grease, suet

akai, to drown

aka, to shut, to nail

akat, foot, sole of the foot

akat, a claw

akt, dried up, nail

akt, foot, nail (of the toe)

akam, buckler

am, to eat

ama, impure

am, to stand

amer, a store house

am, to eat

am, "

ama, to give

ama, clay, potters' earth

am am, fresh food

amma, a lacing, a hand net

a an

amer, a storehouse

amt, devourer

amam, devourer

am, to eat

am "

ama, to know, to understand

amam, to eat, to swallow, devour

amamu, to perceive, to distinguish, to understand, to learn

amamu, " "

amani, a pasturage

am, to swallow

ant, to seize

an sxai, to paint, write, a scribe

an, to turn, to turn and implore,

an, scribe, priest

an, see, appearance, aspect

an, " " "

an, appear, show

an, return; (is used as 're' in reply, return, retort).

an, a board

an an, a skull

anebu, grapes

anbu, a wall

anbu, shut, walled, enclosed, enclosure

anheb t, a bird, a Cornish Chough

ani, an ape

ani, the lintel of a door

anem, a precious stone, a pearl

annu, } to turn, to turn and implore,
annu, } to invoke " "

an

anem, nothing, the least

anen, to turn back

anen, " "

anenbu, a bird of the finest kind

anent, holder of a mast

anen, to look back

annu " "

annu, see, mark, shew, indicate

annu, cries, exclamations

annu, tablet

ant, a collar

ant, yellow color

ant, light, array of light,

ant, destroy, annihilate, affliction

ant, light, array of light

ant, yellow

ant, ointment

ant, to anoint

ant, a collar

ant, yellow color

ant, a ring

ant, thumb, claw

ant, a claw

ant, time o' day

antā, perfume

antā "

anti "

anti, perfume of Arabia

anti, image, likeness

anti, a bright color

anti, bright colors

ant a King

ant, a vase, a jar

an

anlū, appear

anlū, a division of land

anṯ, life

anṯh, to exist, to subsist

an, to go back.

an " "

anṯ, incense

an, to appear

annu, to howl

anṯi, a palace

aṯ, to mount, to rise

aṯ, to fly

aṯ,

aṯa, to mount

aṯ, a pyramid, a tomb

aṯi, a fly or scarabeus

aṯi, to fly

aṯi, the winged solar disk

aṯṯ, mount

aṯaṯ, to mount, rise up, run

aṯaṯ, to mount, to raise, to elevate

aṯoṯ, Aṯoṯhis

aṯaṯ " the Serpent

aṯeṯ " "

aṯṯ " "

aṯaṯi to elevate, raise, rise

aṯaṯi " " "

aṯer u an order of priests, novices of the temple

aṯr, preparer of -

aṯr, equip, furnish, garnish

aṯr, intelligent, able, skillful

aṯr, " " "

aṯ, ar

aṯer, intelligent, able, skillful

arṯn, course, bank of a river

aṯṯh, a tortoise

aṯṯh, "

ar, a gazelle

ar, a small stone, a pebble

ar, rump

ar, gazelle

ar, a scripture, book, volume, roll

ar, to go along, bear off

ar, to mount, to ascend

ar, a scripture, book, volume, roll

arar, to impose

arrar, seed

aref, seize, grasp, hold

aref, a packet, package

ari, a lintel

ariṯ "

ari, ascend

ariṯ, bottom

ariṯ, staircase, hall

ariṯ, house, palace, pylon, ark, shrine

ari, plant

ari, to carry off, to take, to lift

ari, to recapitulate, to enumerate, to remember, to recall

arḳ, an oath, to weave, the 30th day of the month

arḳ, finished, ended,

arḳi, to limit, to decree, to fix by decree, the last day of the month

ara ṯ, uræus

ar, al

arrar, libroeus

aremt, quadruped

arer, a staircase

arert "

arert "

ar a magazine, a store house

arru, tree, jamb

arti, eyelids

arti, buttocks

arti, "

aru skin prepared for writing on, page

aru " " "

art " " "

arut, struggle, oppose

arut, " "

alu, crocodile

at, a fish, (sturgeon)

ata t, reed

ata, earth, soil, land

ati t, lintel of a door

att, barge of the setting sun.

at, hear, words

at, young boy

at, certainly

alef, crown

atat, to praise, to glorify

atat, a lad

atat hear

stat, disclose, detect

atalu, young people

alu, a young girl

at, domicile, house, palace

al, a limb, a part

at au

at, house, palace, domicile, residence

at, " " " "

at, a goat

at, a fish

at, grease

at, wash

atat, to consolidate, to subject

atari, guardian of the temple

alef, fly, bee?

alu, fat, grease

alekhu, apothecary, prepare medicines

alexuu, caster, smelter, founder

att, cabin

at t Knead

at, violate

ata "

atai, to fail, to be culpable

ata, violate

atau, the evil, the guilty

the unrighteous

au, a jar, a liquid measure

aunru, small stones, pebbles

au, born, issue

au, despatch

aua, captain

auau, chastise

auau, rings, bracelets

auf, chastise

auf, "

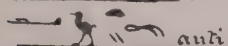
aufu "

aur, a goat

aut, a kind of crane

aw, aχ

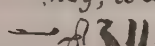
aw, a crook


awi, a list, a roll

awt, matter, material

awaa, reproach

awaai, to violate, steal, annoy, to do evil, to despoil; ex:

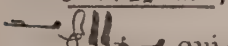

awaai p' sen sha, to carry off their crops.

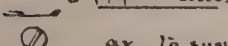
awaawi length

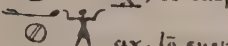
awaawi "

awaaw, the waters of devastation

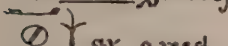
awi, kidnap, rob

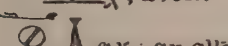

awi, gainsay, catch

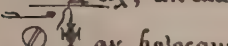

aχ, to suspend; aχ pet, bearer of heaven

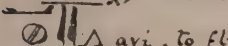

aχ, to suspend, to turn, to bear

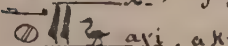
aχ to suspend, to adjust


aχ, a reed

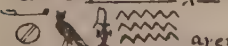

aχ, an altar, a censer


aχ, holocaust, brazier to burn incense on


aχi, to fly


aχi, a kind of bird

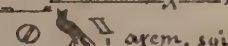
aχem, to extinguish

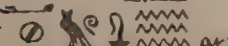

aχem "

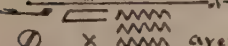
aχem, bandaged, swathed, wrapped

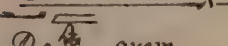
aχem, extinguish, wrap

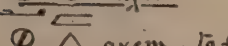
aχem, river bank, wave


aχem, soil, earth, land, field


aχmu, consume, extinguish


aχem, extinguish


aχem "


aχem, to fly

aχ, ash

aχem, lamps, censers

aχem, extinguish, wrap

aχem, bandage, wrap, swathe

aχem, eagle

aχem, the branch of a tree.

aχem, soil, earth, land, field, part of a vessel

aχmi, to soar

aχen, to sleep, to wink, to close the eye

aχt, to suspend, to bear up

aχu, " "

aχ, to rise, to fly

aχu, a censer. aχu to melt

aχu, "

aχu, fever

aχeχ, dragon

aχeχ, to fly

aχeχ, a griffin

aχai, to fly

aχem, force, difficulty

aχen, a grove

aχimu, an eagle

aχlēr, a lark

aχem a bird

aχuu a plant

aχai, to bear, to suspend,

ash, cry, plaint, call, invert, turn

ash " " " " "

ash " " " " "

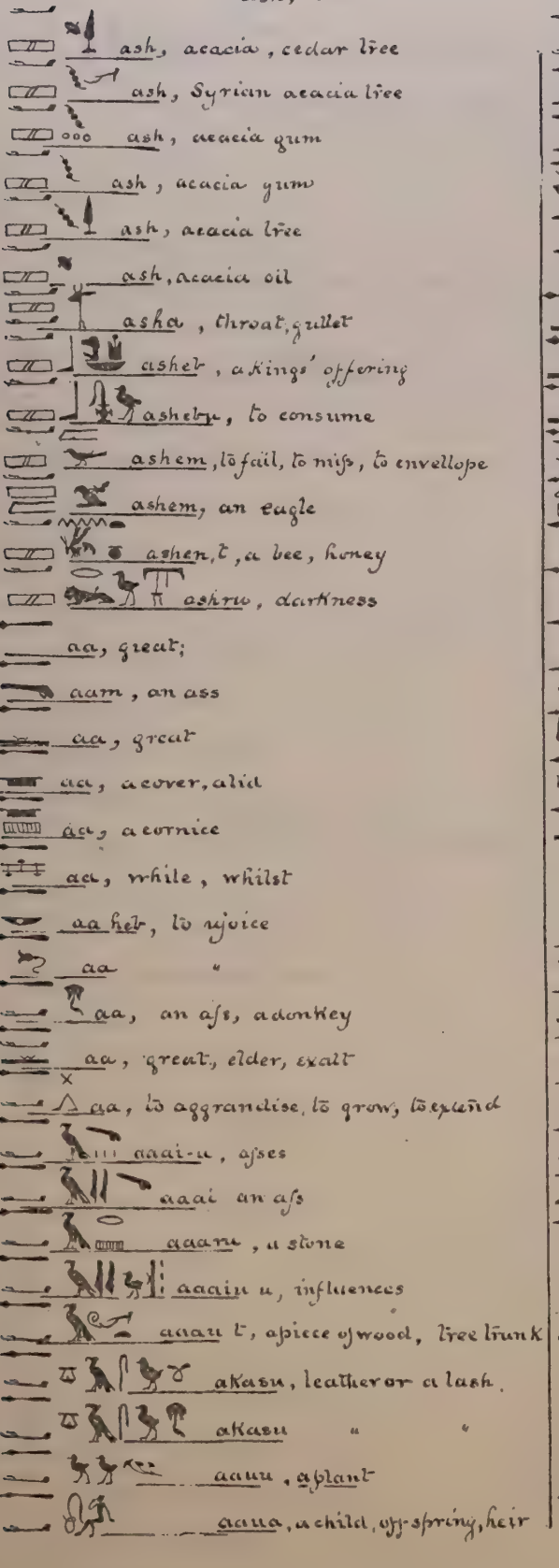
ash, answer, call, declare, explain

ash to enter

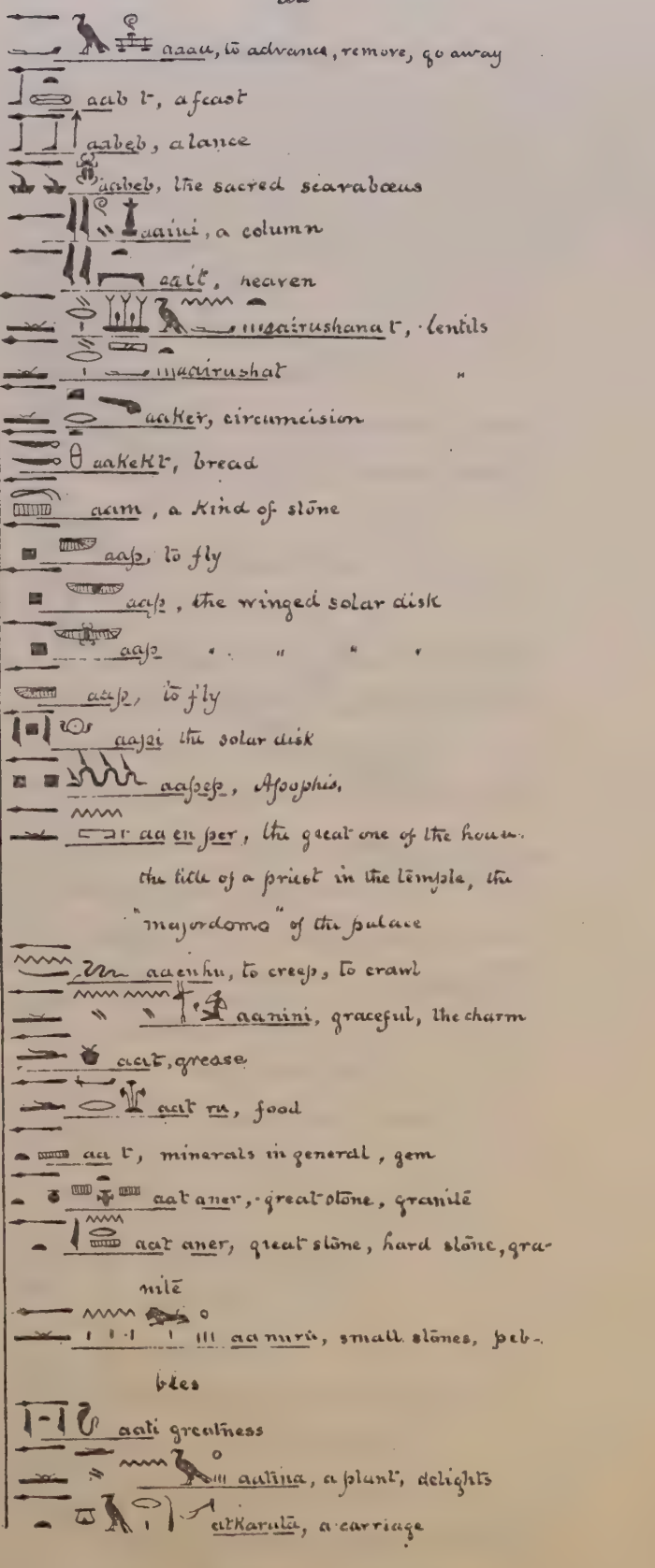
ash, many, numerous

ash, beer jar

ash, aa


ash, acacia, cedar tree
ash, Syrian acacia tree
ash, acacia gum
ash, acacia gum
ash, acacia tree
ash, acacia oil
asha, throat, gullet
ashet, a Kings' offering
ashebu, to consume
ashem, to fail, to miss, to envellope
ashem, an eagle
ashent, a bee, honey
ashru, darkness
aa, great;
aam, an ass
aa, great
aa, a cover, a lid
aa, a cornice
aa, while, whilst
aa het, to rejoice
aa "
aa, an ass, a donkey
aa, great, elder, exalt
aa, to aggrandise, to grow, to expand
aaai-u, asses
aaai an ass
aaanu, a stone
aaaiu u, influences
aaau t, a piece of wood, tree trunk
akasu, leather or a lash
akasu " "
aauu, a plant
aaua, a child, offspring, heir

aa


aaau, to advance, remove, go away
aab t, a feast
aabeb, a lance
aabeb, the sacred scarabæus
aaiui, a column
aait, heaven
aairushanat, lentils
aairushat "
aaker, circumcision
aakekt, bread
aam, a kind of stone
aasp, to fly
aasp, the winged solar disk
aasp " " " "
aasp, to fly
aaspi the solar disk
aaspesp, Apophis,
aa en sper, the great one of the house. the title of a priest in the temple, the "majordomo" of the palace
aaenhu, to creep, to crawl
aanini, graceful, the charm
aaat, grease
aaat ra, food
aa t, minerals in general, gem
aat aner, great stone, granite
aat aner, great stone, hard stone, granite
aa mra, small stones, pebbles
aati greatness
aatina, a plant, delights
atkarata, a carriage

a

aaaabiu, a great wonder, very extraordinary, a great marvel.

a, eyelēt, area

a, a liquid measure

afa, the vice or evil represented by the crocodile

aa, to rejoice, or

aa ape

abeb lance

aa, flesh, heir, inheritance

abeb, sacred scarabæus

aa, grain

gart, uræus

ak, to bind

akai, a plant

akai, "

amu, a title; ans, linen, fine slissf

an, to rule

ant, a kind of evil

ar, a migratory bird

ar, since,

at, labor, rule

at labor, produce

atef, to load

au, the trunk of a tree

au " " or oil of a tree

au, to read

ans, linen

ani t, steal, ravish

axem, to envelop, wrap

axni, to shut the eyes

ab, pure, priest, wash,

ab

ab, pure, priest, wash

at, " " "

ab, " " "

ab, " " "

ab, priest

ab, heavens

ab pure, priest, wash

ab, pure, priest

ab t, washing, embalming place

ab neter steri, incense priest

ab, liver

ab t hai, sanctuary, sepulchre

ab t hut, pure white linen

abuta, pure, right hand

ab, work, skill, the West; uami, right hand

ab-tu, works; ub, workman

aba, a carpenter; ubu, a cook

ab, pass through, opposite

ab, open, lend towards; ubn (light) shine

ab ma, the right hand, (facing South) West

ab ka, a workman. ub, intelligence work

ab m xu, whoever, whatever, whichever it may be

aba, pass through, opposite

abu, work.

abuu, work, skill

abuu, workmen, masons

ab, to cook

abi, against

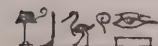
abni, an inspector or comptroller

ab, unction, to anoint

ab, see, look, distinguish

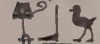
, ab, a terrace or court where the

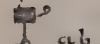
statues of the Gods were exposed to public view

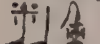

abu, a peristyle, an open court, a terrace, a court in front of a temple

ab, to appear, to make visible

abu, an elephant's tusk

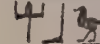

abu, to warm, to excite, zealous, enthusiastic


ab, artist, workman

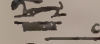

ab, destroy, consume

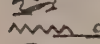
ab, wish, favor

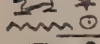
ab, a passage, a terrace, a court

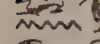

abu, to run, to spring, to dart, to despise, reject, repulse

an, to be, whilst, during


an, open


an, to be, to exist, it is a fact

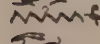

an, an hour

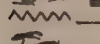

an, to be;
anneb, whoever

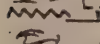
an, shine

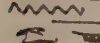
an, horned

an, deficient, vain, light, mock


an, open


an. "


an per, a tomb


an, be

an per het, the ceremony of "the opening of the house" or the cutting into a corpse by an embalmer

an her, to resuscitate, to disengage the head from the mummy wrapps, to uncover it,

an neter ha, Horoscopes

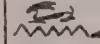
anan, to murmur

an an, to spring up

an an, to hoe

an liti, to extend the arms, to pray

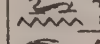
anbu, a bush, thicket, grove


anbi " " "

anef, to be joyful, delighted, charmed

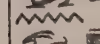
anef, " " "

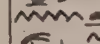
an her, a mirror


an her "

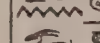
annu, we are

anni, an assembly of mortals


anesh, to lay low, to destroy


anesht, affliction, dejection

an ent, beings

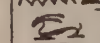

annu, hour

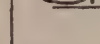
annet, "

annu, to rise, to hold

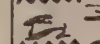
annu, rest, repose

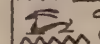
annet, hour


annet, a name of the double crown


an ru, the opener of the mouth,
neter an ru, a priests' title

ant, a stronghold


an lil, open handed, generous


anx, a strap, to dress, to put on

anx, to dress, to put on

anxu, covering, planking, sheathing

ansh, a dog, bloodhound,

ansh " "

aner, a little door opener.

an, au

anulēn, the soil

anχu, living beings; anχ, life, live, exist

anχit, ears

anχ ur, nutritious plants

anχ, a nosegay

anχ an meri, a plant, a shrub

anχ u, food, aliment

anχ, life, living, live, to be.

anχ, a native of a district

anχ, a goat

anχu, "

anχ, oil of life

anχit, a woman of the town

anχit, a flower

anχ tāui, a quarter of Memphis

anχ life, live, living

anχ am, a flower, a variety of acacia, the wood was used in making amulets

anχt, a mirror

anχt, an ear

anχ sett, the East, the region of life

anχ tā, living: tā forms the gerund

anχ, to swear, to take an oath

anχ, " " "

anχ tetā, life everlasting, "living forever," was placed after the title of a living King: tāt anχ, "giver of life" was placed after the title of a defunct King.

au, joy, magnanimity

au hati, joy, magnanimity

au, long, length, triumph:

au, aa.

auui, to cut asunder

auui, to pillage, to wreck

auu ur, to ruin; auu ur en anχ, the ruin of life.

auu, efforts, ardor

auu hati, generous, contentment

ausu, the beam of the balance

ausu, " "

auut, bread, cake

auu, food, an offering

auui, large, vast, extended; em au, totally

au, the arm

aa, gives the sense of separation, born

aa, substance, beget

aa, to break, cut, cut asunder

aaaw, to beget a child, an infant

aaa, a liquid, a libation

aai t, a servant (public or private), workmen, a brigade

aauixi, a dog

aauh, pourout, irrigate

ar, beget, shoulder

araa t, sons

aa, return

aau, a dog

aaua t, deceit

aau, a vessel

aaua, heir, child, heritage

auau, " " "

aaua, distinction, decoration

aauh, a sample

aa

aauh, to infuse, to macerate, to sleep

aauit, a cell, a workshop, a factory, a school, a magazine, a wood yard

aauit, " " " "

aauna, authentically, noloriely, real, regular

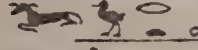
aauna " " " "

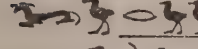
aauni t, hall, colonnade

store house, school, workshop, factory, woodyard

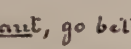
aaunen, a cell

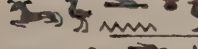
aaur, conception, gravidare

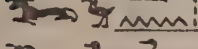
 aaurt, a substance

 aaurnu, deceit

aausu, beam of the balance

aaut, go between, choose, separate, divide;  er aaut, between

 aalennu, earth, soil, dust

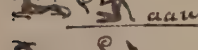
 aalen u " " "

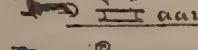
aan t, uncleanness, filth

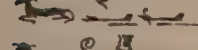
aauuaa, a kind of fish

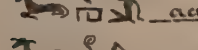
auuaauti, living, priestesses or female ministers

aau, to cease, to interrupt, to cut asunder

 aau, to explain, to bark

 aau, edge, border, bank

 aaua, reward

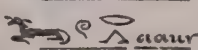
 aauh, to raise, to carry

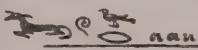
aauh, to raise, to carry

aa, au, at

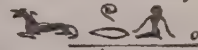
aunen, hall, colonnade

aaur, enter, go between, beget

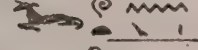
 aaur, " " , to be enceinte

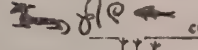
 aaunr, a great vice, a great fault

aaus " " " "

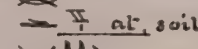
 aaur, conception, gravidare

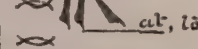
aaut, to leave a place, to go anywhere

 aauten, earth, soil, dust

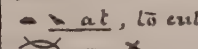
 auau, a fish of the delta

au, Arabian incense

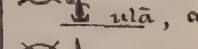
 at, soil, land, earth

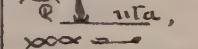
 at, to cut, to wound, the sword

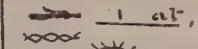
atet, the barge of the setting sun

 at, to cut, to wound, the sword

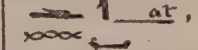
at, to ameliorate

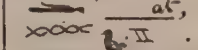
 ula, an amulet

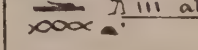
 ula, "

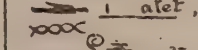
 at, a measure, an ell

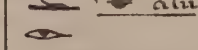
at, a fish or crab

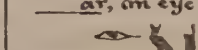
 at, to traverse, pass over, pass through

 at, to pass, to slip, to drop

 alu u, furrows

 atet, to pass

 alu, fat, grease

 ar, an eye, to make, to see, to do, to place;

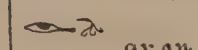
ari em ast, put in the place.

ar, make, do, place

art Har, the eye of Horus, light

art " , " the ula

art Har, the work of Horus, Fire as an elementary God

 ar an, a hair-dresser

ar,

arit u, that has been done

ari sep sen, twice done, a second time undertaken, made re

ar shar kut, a garment

arritu, deeds, actions, works, undertakings.

armaa, to see, to behold

ermâ, a mirror

armaa, to see, to behold, to look

armui, to see

aru, fruitful

arut, constructed

ar kat, to say, a variant of kat

utâ, the mystic eye

uian, to go, to start on a journey

uâ, heaven

ar, the pupil of the eye

ar an, by

ar hetep, basket making

ar hetep " "

anten, a calf

an, to be

after

naxt, power

ait, a step

ak peri, coming in and going out.

aai, to come, to bring

am, secondator, before, in front

amt, road, way

am, race of people

mat, middle, witness, evidence, short

amti, all judicial acts are so called

amt the abyss

am

 amt, inundation

 am, a bull

an, "

 amt, a garment, a cloak

 amt, a mother

am, a joint of the body

 amtu, an ejaculation, venom

 amt, poison, venom

 ami, justice; amshu, justice

 amt humerus

 amt, middle, appoint, convention, time

 amt, a sash, a girdle

 amti, wave, the surface of the water

 amti, sing, praise.

 amti, just, true

 am hit, in the midst, the middle, the tomb

 am amt, a house occupied by many

 amti, just, true;

 amtu, a sound, to call, to speak out, just

 amti, to examine, inquest, interrogate

 amti, when preceded by , about, nearly, around, about the time of

 amtên, examiner of condition, inspector of temples, monuments &c

 amnit, a battle axe

amènnui repose quiet, precept

 amtêr, noon, midday

 amtêr, a pond or a marsh

 amtêr, sometimes marks a fault, as,

 nen amtêr a, I have not been dilatory

 amtêr, to witness, to render justice

a

amt, a pond or marsh

amtēr, tō examine, tō spy, a spy

amtēr, tō tȳ, tō examine

amtēr-ut, tō soil, tō stain

amtēt, time

amtet, time, season, midday

amtū, venom, poison

amt, veins, conduits of maladies

amtēt r, tō examine

am am t, unheard

amru neferu, good

Witnesses, good evidence

amtēru, tō judge tō examine, a

amurū, spy, tō spy, " "

amtēru, venom, poison

amtūu, investigation, inquiry

apt, Thebes

aptēn per hemtū, harem, women's

house. suten hemt, King's wo-

men; per shentu, harem

axut per heh, house of the eternal

horizon, the tomb; figuratively

the condition of the deceased, or

the deceased himself

a minutē, instantaneous, sudden

aximu, Stellar Gods, is generally accom-

panied by one or more stars; The guides

of the solar barges

a, minutē, instantaneous, sudden

a " " "

aatē, scourge, enemy, out-

cast

aaa, avase, a liquid, measure

a, ah

aash, the name of a God

aaaui, clumsy, inapt

aaau, " " "

aaani, an ape

aab, the contrary, opposed

aabt " "

aankhu, a class of employées men-

tioned in the judiciary papyrus of

Turin

aas, a javelin

aaset, a siege

ab, offerings

afti, increase (Brugsch) cap, terrible (Birch) (Lefebure)

afa, satiated

afer, tō burn,

aft, tō distill, tō exude

aft, some part of the leg, tō jump

tō bound, tō rebound

ah, a field

aht, "

aht a medicine, a remedy

ahen, a weight

ahu, tō form, tō model

ahu, a field

ah, tō enter

ah, a cow

ahat "

aha "

aha, want, sad fault, anguish

ahit, a cow

ahit, movement, advance re

ahem, incense

ai, tō fix, tō put in order

ak, am

ai, male

ai't, substance, embryo

" akiu, the inferiors, those who adore, who prostrate themselves.

aker, sphynx

aker, "

aker, a viper

aker, the mythologic viper A-Ker

akat, violence

aka, to sit down, to rest

akeb, to call, to cry out

akep, to destroy

akep, "

aq, to go, to enter

ak " "

akebiu, multiplied

akehu, an axe, hatchet

akek, to nurse a child

aku, violence

aksu, to tie, to bind, to chain

aku, lost, to lose, to injure

ak, humidity, damp, moist

ak, the water of the firmament above

akab, a window

am, clinch, grasp, fist

amni, to lay hands on-

amn, the fist, to seize, to grasp

am, to seize, to grasp

ames, the insignia of the whip

ams, " "

am, a fist

amem "

am, as

ames, the insignia the whip

am, heat, fire, consume

am, fluid

amau, rubbed with oil, anointed

amia, to mix, a mixture

amiu, " "

am, the fist

ames, the insignia the whip

anua, to labor, to work

asp, to count

asp, an account

aspt, a duck

ar, a measure space

ar, superior

ark, extremity; arkt, to vomit

arer, grasses

art, rump

ark, "

ar, grasses

as, a part or secretion of the body

as, to hasten, speed

as, a fugitive

as, when preceded by

iebeh tu en- refers to the sacred utensils

aseb, a siege

aseb, to burn, to consume

asbi, fire, flame, to consume

asbu, consumed

as, haste, speed

asep, to mow

asep, harvest

asep, "

at

asex, harvest

asex, "

at, violence, crocodile, outcast, multitude, to wound.

ati, violence, to wound

atu, a fish

atu, an evil doer (man), a highway.

atef, to distill, to exude

atef, the name of a tree

ateh a swamp

atehu a swamp

a t, a minute, a moment, an instant

a t, a station

ata, clay

ati, the hills

at, distill, exude

atef, headdress of Horus

atef, the name of a tree

atef, a cutting instrument

at, outcast, enemy, scourge, plague

at, the back

at (tamer) weavers

atet, cells

ati, danger

ates, to load, to carry

ata, a bed, a couch

at, a minute, an instant

ata, a chip, a shaving

atat t, fraud, falsehood

ati, a bed, a couch

atat, a school, a scholar

au, proceeding, as it goes

au, an old man, old age

ax, b

ausek, a case

aut, the exterior covering of the mummy, the outer wrap

auau, to praise, to adore

the prenom of the Emperors.

auaauaa, to consume

ax, to shoot, to draw an arrow from the quiver

axt, a thing, a dignity, an honor

axax, a meadow

axax, evening, darkness

axex, articulation

axa, darkness

axa, to sculpture, carve, engrave

asha, to mow

asha, "

asher, a slice

asher u slices

asher, to inflame

asherf

asherf a slice

asherf "

B

bu, place, not; embu ug, in one place

bu, a metal, a stone

bu, to walk, pedestrian, traveller

bu, a place, a house; tat bu aker, to say the perfect thing, to speak in the right place.

bu ta, the earth

bu, the fire pools of the damned

ba, a metal, iron

ba

bu, bestow, a mine, a quarry.

ba, a blade, a sharp edged instrument

ba, a palm tree, palm wood

ba, a road, highway, path

ba " " "

ba t " " "

ba, the sacred barge

baa, a road, highway, a path

ba, to pay

ba, wood

ba t, offering bread

ba, food, bread

ba, the soul

baa t, recompense

ba u, arrivals, convoys

baat, to be astonished, to be in a state of admiration, wonder, a marvel, a wonderful remedy, meritorious; em baa t, to be in a perfect condition, extraordinary

baa t " " " "

baa en pet, magnetic iron magnet.

banii t, a hard kind of stone much used in the construction of monuments in Egypt

baai u, marvels

bab, to exhale

bak, a hawk

ba, a mine

baan t, wondrous, marvellous, miracles, wonderful things

ba

ban, no, not

banur, bad, fatal

banur, no, not

baner, a date tree, elegance, delight, sweet; baner ru. nelem lut, sweet mouthed, sweet worded

ban, a dart, a javelin

ban, a harp

ban, dates

ban, enviable

bat, barley

bat, food, rations

bat " "

bat a mine, hill

bau, matter

ba, a mast

ba, illumine, shine, radiant

ba, obey

baa, to contradict; a form of

ba, illumine, radiant

ba, water, drink

ba, a portion,

baa, a clod, a bath, a clod, a measure

basu, a leopard

baba, to boast

babu, to be clean, clear, pure

bah, abundance

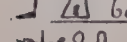
bah, abundance, to water, to fill, to inundate

bah " " " "

bah, to supply, to gorge

b

ba, to fill, to inundate

 bahes, wild beasts in general, the larger game of the hunt

beb, a radical with the sense of circle, round

beb, to circulate, revolve, to make a revolution, to turn

beb, a collar

beb t, to turn, whirl, a whirlpool

beb, a Typhonian animal

beb, a well

beb t, a branch

beb t, a place, a niche, a recess

ba, a hole, a cavern

ba, to dig, to hoe

ba, " "

ba, to dig, to excavate

ba, a mallet, a hammer

bakiu, drawers of water

bait, a house

bak, a phallus

bak a fig tree

babau, to turn, to circulate, to evolve

baksu, a dagger

bast, a bench

baka, to squat, to bring forth

ba t, an ear of corn, wheat &c

baa, herbs

baa, to dig a hole, to excavate

bau, a tree

baba, to turn, to face about

baba, a Typhonian animal

baba t, a hole or cavern

b

 babau, a Typhonian animal

 baba, a hole or cavern

 baba, stupid

 bah, phallus

 bai t, a mast

 bairu, a boat, bark

 babaka, to watch over, to guard,

 bai, a kind of food

 baku, laborers

 bakasu, a leopard

 bakasu, to rest, to weaken, to cease, to squat, depress, to bring forth, naked, to relax, idle, helpless, miserable

 barui,

 barikabuta, a fish pond, a pool, a cistern, a pool

 baruka, to kneel, to adore

 bari, a boat

 bari, " "

 bari, a fish of L.E.

 beka, tomorrow, tomorrow morning

 buru, outside

 ba t barley

 batana, a stick

 baka, shine, anoint

 bauh, phallus but, the mouth of the grave

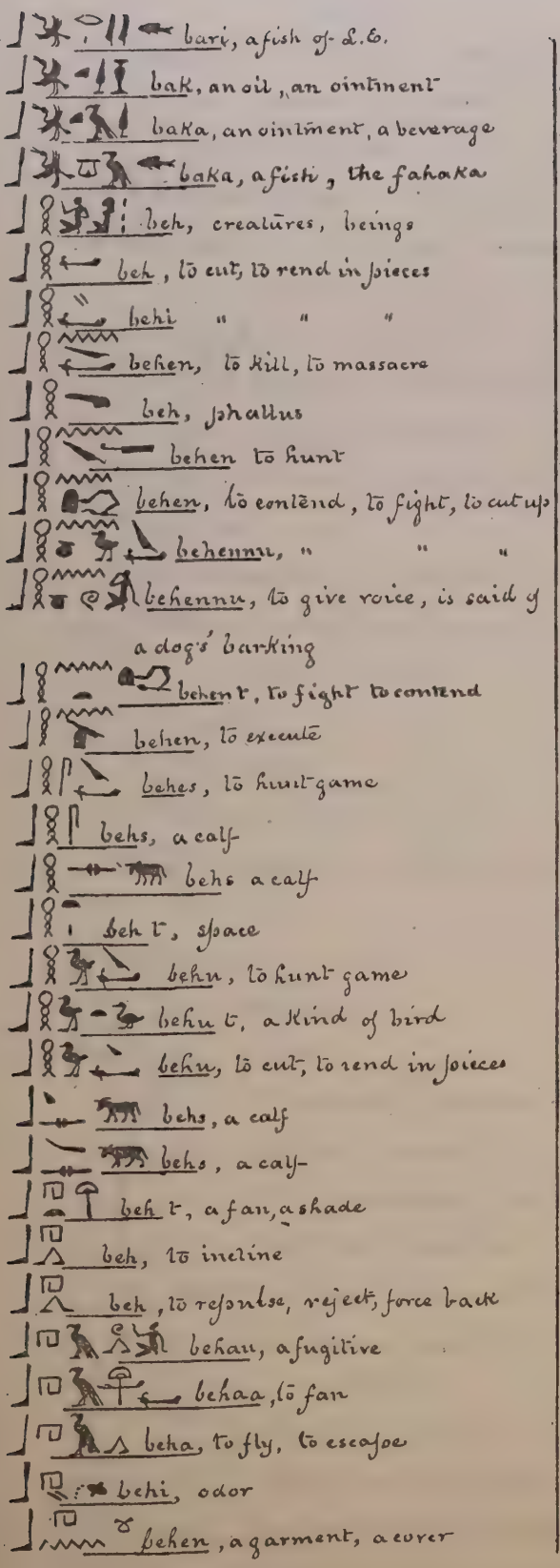
 bai, a medicine

 bai, a boat

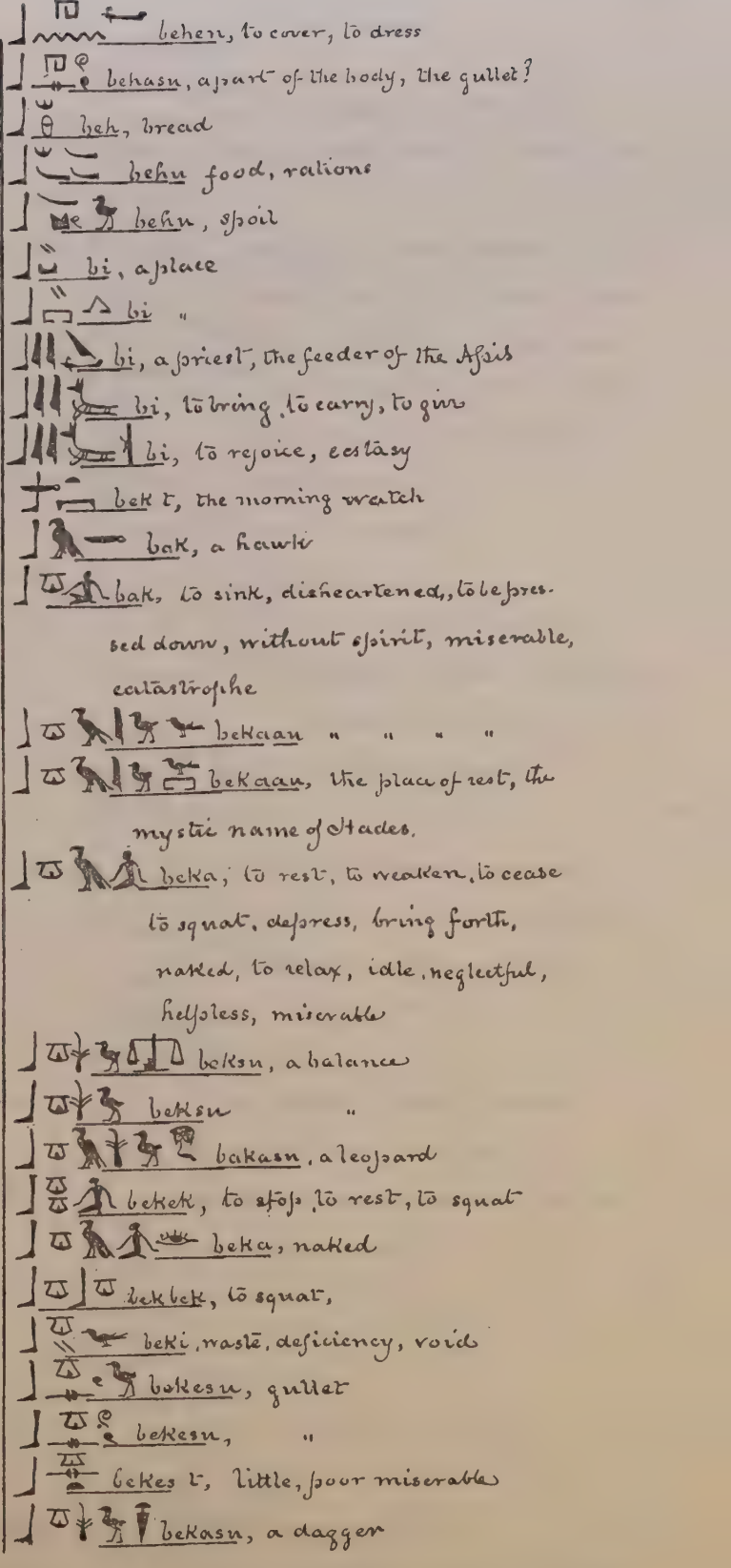
 baita, a house

 barui, a boat

beh


bari, a fish of L.E.
bak, an oil, an ointment
baka, an ointment, a beverage
baka, a fist, the fahaka
beh, creatures, beings
bek, to cut, to rend in pieces
behi " " "
behen, to kill, to massacre
beh, phallus
behen to hunt
behen, to contend, to fight, to cut up
behennu, " " "
behennu, to give voice, is said of a dog's barking
behent, to fight to contend
behen, to execute
behes, to hunt game
behs, a calf
behs a calf
beht, space
behu, to hunt game
behut, a kind of bird
behu, to cut, to rend in pieces
behs, a calf
behs, a calf
beht, a fan, a shade
beh, to incline
beh, to repulse, reject, force back
behau, a fugitive
behaa, to fan
beha, to fly, to escape
behi, odor
behen, a garment, a cover

bek


behen, to cover, to dress
behasu, a part of the body, the gullet?
beh, bread
behu food, rations
behu, spoil
bi, a place
bi "
bi, a priest, the feeder of the Apis
bi, to bring, to carry, to give
bi, to rejoice, ecstasy
bekt, the morning watch
bak, a hawk
bak, to sink, disheartened, to be depressed down, without spirit, miserable, calamitous
bekaau " " " "
bekaau, the place of rest, the mystic name of Hades.
beka, to rest, to weaken, to cease to squat, depress, bring forth, naked, to relax, idle, neglectful, helpless, miserable
beksu, a balance
beksu "
bakasu, a leopard
bekek, to stop, to rest, to squat
beka, naked
bekbek, to squat,
beki, waste, deficiency, void
bekesu, gullet
bekesu, "
bekest, little, poor miserable
bekasu, a dagger

bek, a palm tree, an ointment

bek, a palm tree blossom

bek, palm wine

bekhait, a city

beki, to decrease, to descend, the subsidence of a river

beken, an altar

bekennu, warrior, spearman

bekenken, the insignia

bek, an oil, an ointment, the stick

bek " "

bekenken, the insignia, the stick

beker, a seat, a staircase

bekeu, a balance

bekeu "

bekeu

beka, light, to shine

bekatu tomorrow, tomorrow morning.

beka't, " " " " "

ben, no, not

ben, to pollute

ben, Phœnix: ban, date tree

ben, protection, warmth

benr, dates, sweetmeats, sweets,

bener, sweetmeats, preserves

ben, to circulate, to turn, a circuit

ban, bad, fatal, unfortunate

bena't, a palm tree

bena, palm branches

benben, delights, delicious

benben, wood of the palm tree

benben, to make water issue from its source

benben, cassolone, lip

benen, a circle, a ring, a hoop, amulet

" " " " "

benben, a palm branch

benent, the ring of a hippodrome

benen, the phallic name of Horus

benbent, the roof of a house

bennu, bad, fatal, unfortunate

benef, warmth

benen, a serpent

bennu, no, not

bennu, Phœnix, Nycticorax

benenfu, to invert, to turn away, to pervert, a pervert

bener, date palm, sweet

bener " " "

bener, the outside, the way out

bener, the road, outside, the way out

benerot, a palm, date tree

bener a palm, date tree

benra, " " "

bennut, a kind of stone

bennu, a son, a child

bent, to tie, to bandage, to swathe

bent, powerless

bent, to fall

bent, a harp

bent "

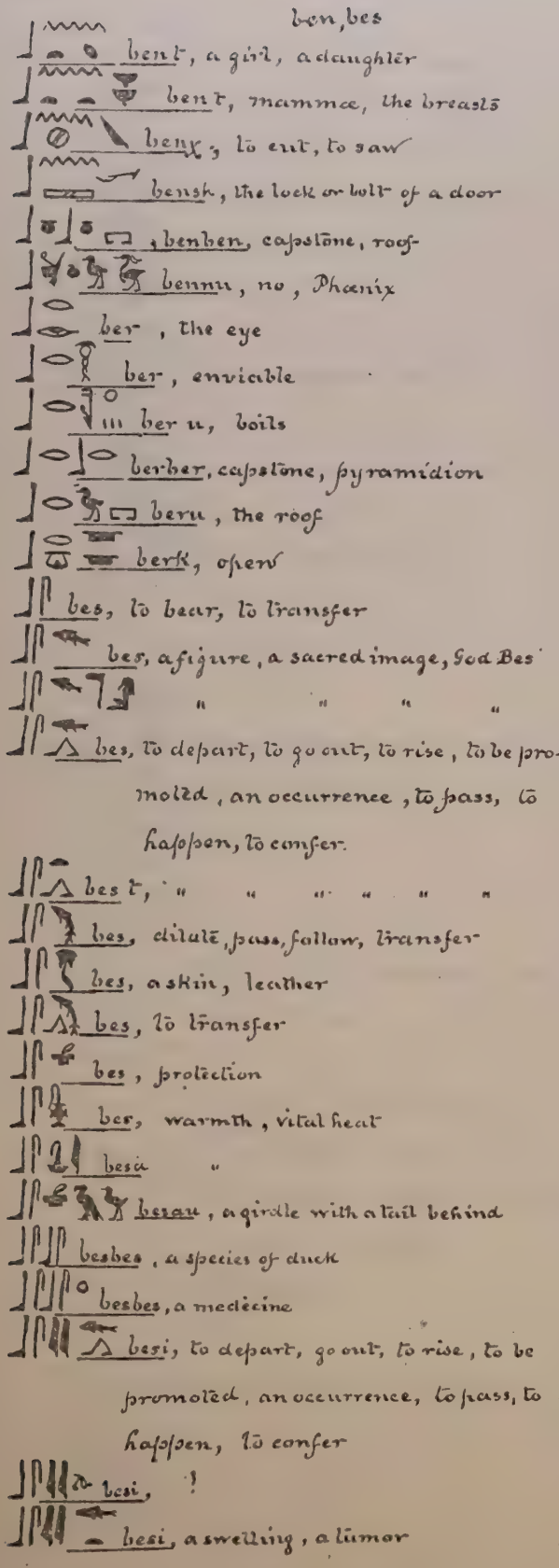
bent, an ape, cynocephalus

bent " "

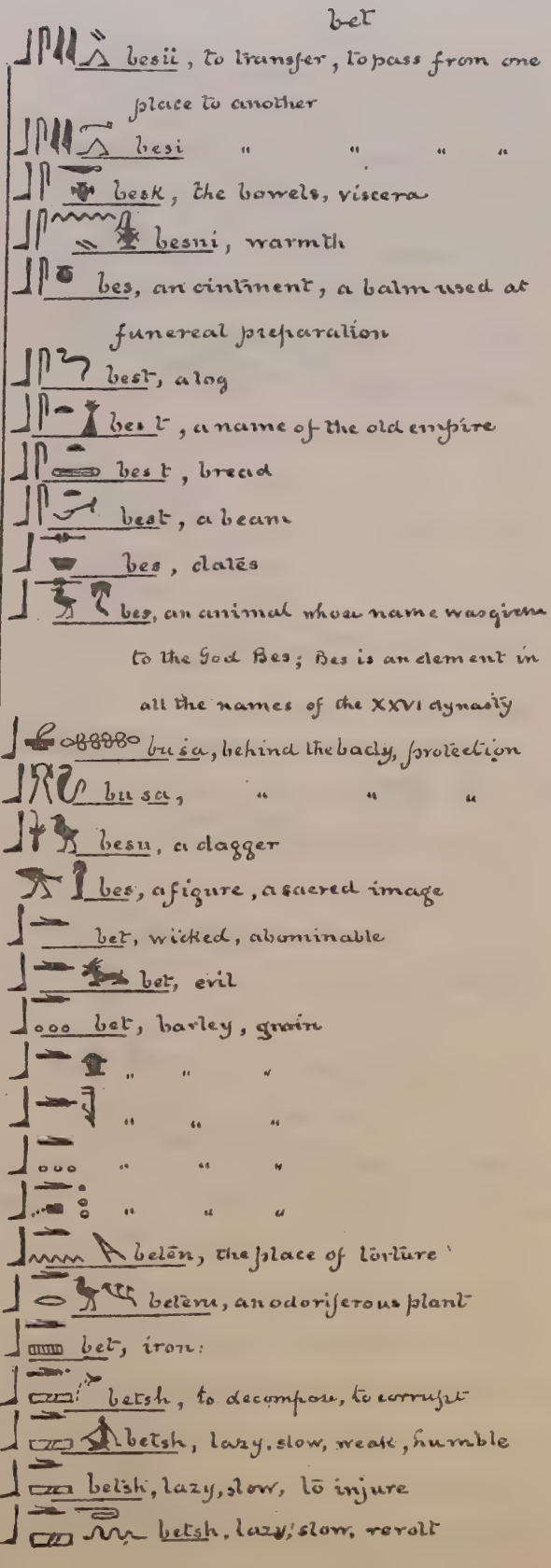
benaui, apes

bent, a measure of dates, excellent

ben, bes


bent, a girl, a daughter
bent, mammæ, the breasts
benx, to cut, to saw
bensh, the lock or bolt of a door
benben, capstone, roof
bennu, no, Phœnix
ber, the eye
ber, enviable
ber u, boils
berber, capstone, pyramidion
beru, the roof
berk, open
bes, to bear, to transfer
bes, a figure, a sacred image, God Bes
" " " "
bes, to depart, to go out, to rise, to be promoted, an occurrence, to pass, to happen, to confer
best, " " " " " "
bes, dilute, pass, follow, transfer
bes, a skin, leather
bes, to transfer
bes, protection
ber, warmth, vital heat
besa "
berau, a girdle with a tail behind
besbes, a species of duck
besbes, a medicine
besi, to depart, go out, to rise, to be promoted, an occurrence, to pass, to happen, to confer
besi, !
besi, a swelling, a tumor

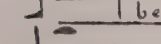
bet


besii, to transfer, to pass from one place to another
besi " " " "
besk, the bowels, viscera
besni, warmth
bes, an ointment, a balm used at funereal preparation
best, a log
best, a name of the old empire
best, bread
best, a beam
bes, dates
bes, an animal whose name was given to the God Bes; Bes is an element in all the names of the XXVI dynasty
busa, behind the body, protection
busa, " " "
besu, a dagger
bes, a figure, a sacred image
bet, wicked, abominable
bet, evil
bet, barley, grain
" " "
" " "
" " "
" " "
belan, the place of torture
belenu, an odoriferous plant
bet, iron
betsh, to decompose, to corrupt
betsh, lazy, slow, weak, humble
belsh, lazy, slow, to injure
betsh, lazy, slow, revolt

bet

bet'sh, lazy, slow, revolt,

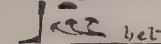
bet, a resin for purification


bet, abominable, bad

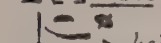
bet, abominable, infamous

bet, barley, corn

bet " "


bet, a place

bet, a elephants' tusk


bet " "

bet, a pastor, shepherd

betā, a gift

betā, infamous, evil

betā, infamy

beb t, a stream

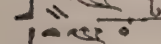
bebti "

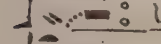
beti, an ape

bəti, barley, corn

beti " "

beti " "


beti " "

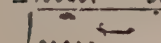

bel'ek, to fight, to vanquish, vanquish

belēn, to run

" "

belēnlū, cynocephalus ape

belēnaui, apes


belēnnu, culpable, convict, male-

factor, scoundrel

belēnnu " " "

" " " "

belēn hati, the evil hearted

belēn, guilty, convict, bad

belū, bad, infamous

belīu, boatman

bu

belēnnu, to rebel, a rebel

bet, barley, corn

betā, a topmast

bet, iron

bet, a workman, mason

bet, a resin for purification

bu, negative particle 'no', a place, ex:

embah bu nebu, in

the place of people all, ie. publicly

bu, wood

buia, infamous, hateful

buk, palm wine

bu'ru, out, outside;

am nen ek peri bu'ru malēnu neb,

beno thou go out of road any, ie. do not

go out of the road-

ma ai er bu'ru, an order

to set forth, depart.

bun t, dates

bu'ru, out, outside, the corridor

buek, 'not thou'

buu, rolls, papyri

bulēr, workman, mason, n

bulūru en mut, crimes

punishable by death, capital crimes

buy, belly

bu, head, archon, wise head

buaa, archon, chief

buau t, very well, exceedingly well

buuaa, wonders, marvels, miracles

buaai, heap, pile, height

buaai, a great man, a superior

bu, bex

an archon, the eminent, the wonderful

bua, to praise, to exalt

buau, to boast

buauu, walking, along

bexeb, a tree or plant

bexem, behemoth, hippopotamus

bexen, to cut, to saw

bexen, green basalt

bexen, a propylon

behext, a retreat, a residence

behennu " "

bexent, a retreat, residence, a fort

a store house

bexen, a pylon, a fort,

bext, a tower

bexax, to refuse without exception

bexex, fire

bexexu "

bex, to bear children

bexen, green basalt

besh, to vomit, spittle, to pour out, flow

besh, to wound, wounded

beshu a variant of

betsh hati sen u

their weak hearts, the weak hearted among them. weak, cowardly, timid, to revolt

beshu, to revolt

beshlā, "

" , "

" , "

" , "

beshli, "

ba

beshlāu, the rebels, hostiles

beshui " "

beshu, weak

beshu, to revolt, hostile

bashes, incense

× beshau, revolt, hostile

ba, the soul

bau, souls, the souls of the Gods, the Kings and also their wills

baura, a book

ba, a hoe

ba, a metal or stone

ba, to saturate, to inundate

baenshuf, a workmans tool

baru, a well, a ditch

bak, an ointment, a beverage

bak, the planking of a vessel, a ladder

baba, a Typhonian animal

baiu, attendants in a temple

bak, servant, laborer, worker

bak, " "

bak t, a province, district, city

baka, a gorge, a valley

bak, a city.

bak, rent, duty,

bak, a servant, carved, to work;

baki em nub, worked with gold, gilded

baki, to envelop, to cover, to swathe

bak, work

baku, merchandise

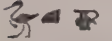
baka, to conceive

baka, city, town

ba

baki t, a city, a town

bak, fine oil


baka " "

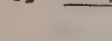
bak t, an ointment, a beverage

ban t, to bandage, bind, swathe.

basant, to incrust, to cover with a metal

balēnu, covered, hidden envelloped,

bat, bread, consecrated bread

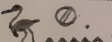

bauii, dignitary

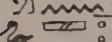
baxen, basalt

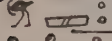
bashesh, incense

bat, barley, corn

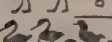
balū " "


ba, the soul

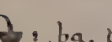

ba, a place, a house

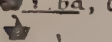

ba, the soul; or nelēr-ba, a priest

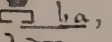
ba, "


ba, book

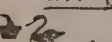
ba, "


bah, in front of - in presence of - before


bamt, to eat food while it is warm

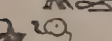

ba, a tree

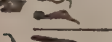
bak, a hawk


bak, shipwreck

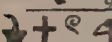
ba, the soul

bak, a hawk


beb, a collar


basha, to cut, to cleave

bak, a hawk


bak "

baks t, the gullet

bak, weak, dejected, miserable

b

bak, an olive tree

bak, to conceive

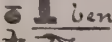
bauti, a field

benben, capstone, pyramidion

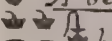
ben, column with palm capital

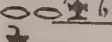
bennu, Phoenix

berber, ebullition, ferror


bat, bad, hateful, infamous.

batnu, the breasts, the mammæ


batn, bad


bati, a metal stylus used in unctions

bua, a magistrate, an archon

baiii, infamous, abominable

bex, to bring forth

betsh, lazy, slow, miserable, revolt, wretch

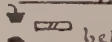
besh, to pour out, to flow, vomit

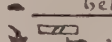
bat, abominable

basu, a dagger, xesef, avoid, repulse, oppose

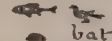
baef, to put away, to stifle, to repulse

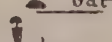
bati, an ointment, a funereal balsam

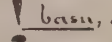

ba, the soul.


bai, a priest's title, 'feeder of Apis'

bau, a pasturage


baneb tatu, a religious feast


ba, iron


ba, personal merit

" " "

" " "

f

F

 sometimes represented No. 20. he, him, it

fi, to carry

fi, to bear, to carry

fi, to bear

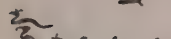
fa, canal

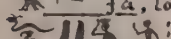
fa, to bear, to carry, to raise;

fa her, to raise the head;

fa lut, to raise the hand-

fa, to bear, to carry

 fai u ushai u, letter carriers

 fai ushi u, " "

fa, to mount,

fekt, reward.

fu, millions

fai, a palanquin. a handbarrow

fai, an offering

fanet, disgust, dishearten

fi, disgusted, revolting.

fila, a kind of wine

fa, veneration, respect, religious fear

fek, a title of the High Priest of Hermo-

polis, in L.E, also a priest of Osiris in Thebes; an allusion to the tonsure

fek, to invade

fekau, reward, fulness

fek, " "

fek u, " "

feka, reward

feka, "

fekau, abundance, rewards

f

fekau, to eat

feka t, river or wash gold

fekt, a bald orshorn man, a priest

 fenka, to chew

 fenka, "

 fennu, dirt, bad,

 fennu, the impulses of the heart, the emotions, 'breathing of the heart'

 fent, the nose

 " "

 fent, a worm

 fenti "

fenti the nose

" "

 " "

 fet, disgust, to fail, revolting, repulsive

 fennuk, to beget one's self

 fet, a plant,

 fent, the nose

 fet, sweat, perspiration

 f-elek, to disperse

 fetka, to sink

 fetfet, an ointment, a spice

 fettem, to perspire, sweat

flu, four, 4

 flu, nostril

 fet, disgust, revolting, repulsive

 fet, four

 fa, to load, measure

 fa, to carry, to bear

 fetfet, a worm

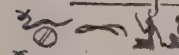
h

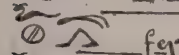
 fetek, to carry off, to destroy, to break

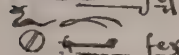
fetekа, " " " " "

fetii t, a plant

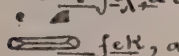
fetu, disgust repulsive, revolting

 fex, captives

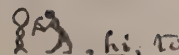
 fex "

 fex, to untie to undress to strip, to deprive, a general idea of dismantling, destruction

fex, a girdle

 fek, a recompense

H

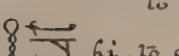
 hi, to strike, to mow wheat, to press, to drag, to go along a road, to go up (the Nile), to augment, to grow, to invade, to touch with an instrument

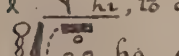
hi, to drag

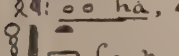
hi "

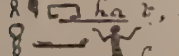
hi, the rise of a river

hi, to get rid of, to put out, to thrust out

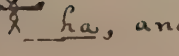
 hi, to draw, to drag

 ha, corn

 ha t, a house

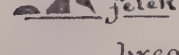
 ha, to rejoice, to adore

hau, the limbs; apt hau, the heads of the limbs, the extremities

 ha, and, with.

ha

ha, to strike

 ha, a sceptre, to touch

 ha u, limbs, self, the flesh, the body.

 ha, flesh

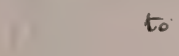
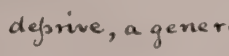
 ha, "

 ha, to fill with water, to inundate

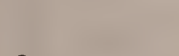
 ha n, flowers

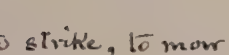
 haai, assuredly, by all means.

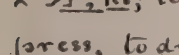
 hat u, rustics, serfs

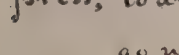
 haa, to adore, to rejoice;  haa un en pa maa ef her s'heb, They rejoiced to see him celebrate a festival

haa to rejoice, a million

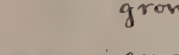
 kabenshen, chess or draughts

 or  han or hna, and, with

 hannu, a vase

 han, to fill, to be filled, to be full

hap, the Nile

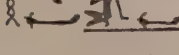
 hapi "

 haru, to be full, to be imbued

 hata, impurity, uncleanness

 hata, compel

 hatā, a bench, a mat, a bed

 hau, a stick, a cane

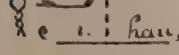
 haulā, to offend, to concede

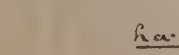
 hau, a cane, a stick

 haut, authority; er hau t ef, under his authority

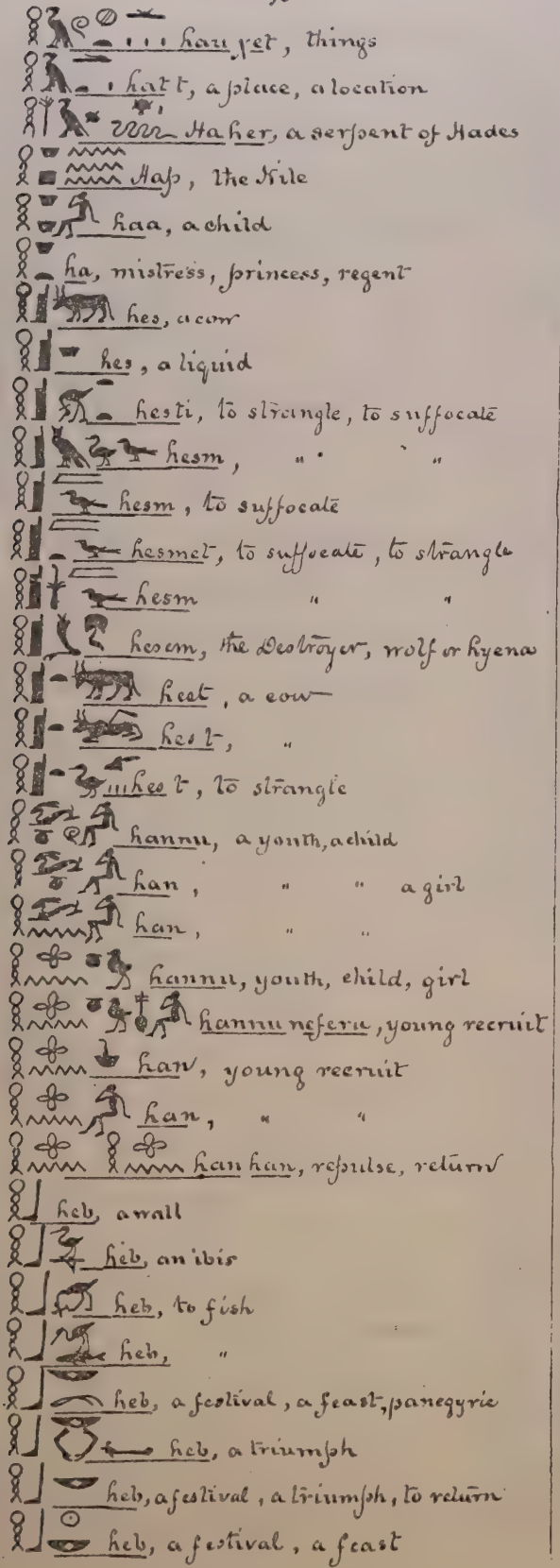
 hau, to rejoice, to adore

 hax, holocaust

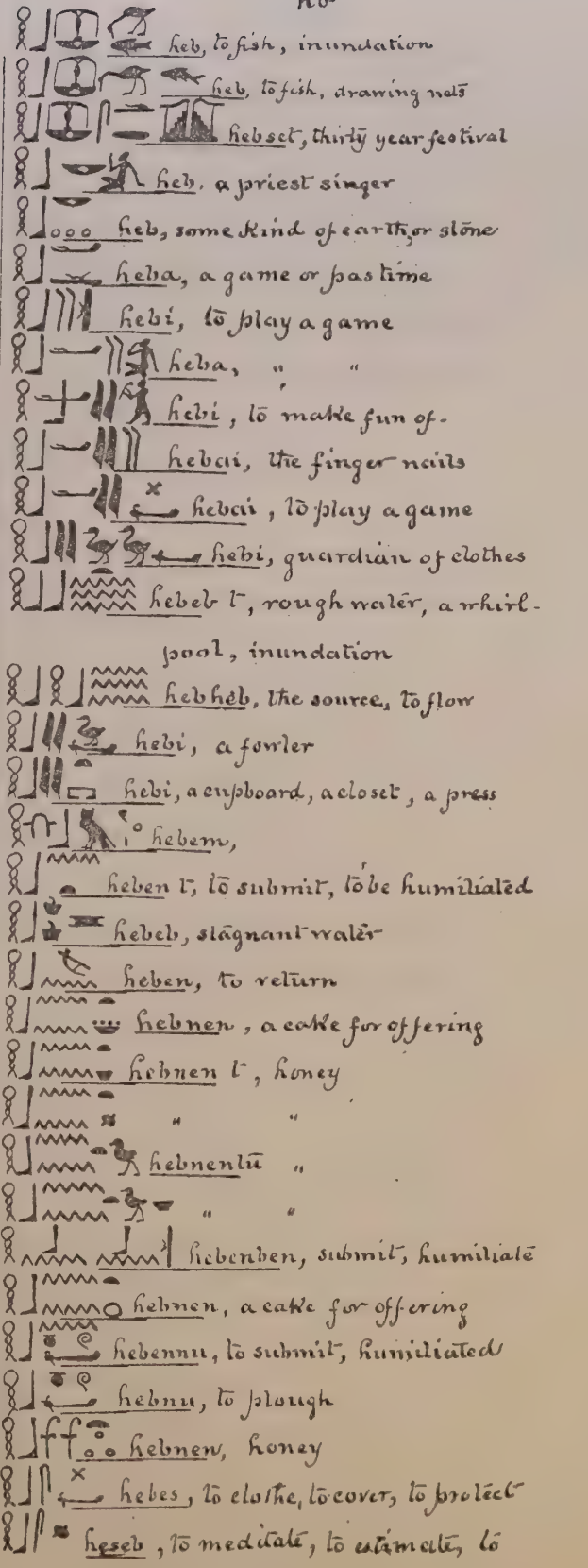
 ha t, clay

 ha t, a rock, a tomb, a shrine

h


hau yet, things
hat t, a place, a location
Hahes, a serpent of Hades
Hapi, the Nile
haa, a child
ha, mistress, princess, regent
hes, a cow
hes, a liquid
hesti, to strangle, to suffocate
hesm, " " "
hesm, to suffocate
hesmet, to suffocate, to strangle
hesm " "
hesem, the Destroyer, wolf or hyena
hest, a cow
hest, "
hhest, to strangle
hannu, a youth, a child
han, " " a girl
han, " "
hannu, youth, child, girl
hannu neferu, young recruit
han, young recruit
han, " "
han han, repulse, return
heb, a wall
heb, an ibis
heb, to fish
heb, "
heb, a festival, a feast, panegyric
heb, a triumph
heb, a festival, a triumph, to return
heb, a festival, a feast

hb


heb, to fish, inundation
heb, to fish, drawing nets
hebset, thirty year festival
heb, a priest singer
heb, some kind of earth or stone
heba, a game or pastime
hebi, to play a game
heba, " "
hebi, to make fun of
hebai, the finger nails
hebai, to play a game
hebi, guardian of clothes
hebeb t, rough water, a whirl-
pool, inundation
hebheb, the source, to flow
hebi, a fowler
hebi, a cupboard, a closet, a press
heben,
heben t, to submit, to be humiliated
hebeb, stagnant water
heben, to return
hebnen, a cake for offering
hebnen t, honey
" "
hebnenti "
" "
hebenben, submit, humiliate
hebnen, a cake for offering
hebennu, to submit, humiliated
hebnu, to plough
hebnem, honey
hebes, to clothe, to cover, to protect
heseb, to meditate, to estimate, to

ḥf

think, to calculate, to converse

heseb, " " " " " "

hebesui, a woman

hebes, to clothe, clothes

hebes, feast, festival, panegyric

hebs, clothes, to clothe

hebes, " "

heb, to recline

hebes, clothes, to clothe

hebt, foam, froth

heb, to cut

heb t, in the act of crying

heb t, weeps, wail

hebu, to celebrate a festival

hebu, a walled enclosure

ḥfi, a snake, a viper

ḥfi " "

ḥfa, prostration

ḥfa, a snake, a viper

ḥfau " "

ḥfa, a gigantic serpent

ḥfi t, to fly, to alight

ḥfi, to fly

ḥfa, to crawl, to prostrate, to humiliate one's self.

ḥfi, a snake

ḥfi, a viper

hefen, to squat, crawl, bend low

hefen, crawl, prostrate, humiliate

hefennu, a tadpole, expresses a great number, 10.000

hefen, a lizard, numerous

hef-t heft, to squat, to sit, to rest

ḥḥ

heft, depression, to sink, to float away, to drift, to let one's self drift

ḥfu, to crawl

heḥ, numerous, many

heḥ, aion, age, eternity; time;

heḥ tetā, time and eternity

heḥ arṣa, old wine, a kind of wine called 'nexit' in Coptic; it was a ration in the Egyptian army.

heḥ, to search, to seek, to provide

heḥ " " "

heḥ, grain

heḥ, to wander, to search, to provide

heḥi, " " "

heḥti, the soles of the feet

heḥ neter, primordial God

heḥ, the inundation

heḥ, an oil or grease

heḥes, a bird

heḥtetsu, the name of the two bandages which were wrapped around the mummy's head

ḥab, a plough, to plough

heḥa, naked

heḥai, to drive back, repulse

heḥaṣa, to hide

heḥai t, haste

heḥi, behind

heḥu, haste

ḥi, to go towards

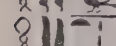
ḥi, a canal, water

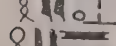
ḥi, to inundate

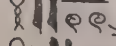
ḥi, wheat, corn

hi, hk

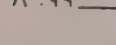
hia, an enemy


hi t, wheat


hi uu, inundation


hii, an inspector, overseer, a spy, a detector, of fugitive slaves

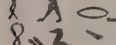
hih, to search, seek, to come with diligence


hii, to strike,

hi nu her, to drag, a battle

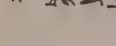
hi u, means, taste

hek, to govern, to give laws, to rule to pronounce magical formulas; magic writings


heken, a hymn

heken, to drink

heken to rule to govern


hekennu, an address

hekennu, preparation for embalming

hekennu, a discourse

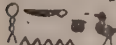
" "

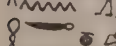
" "

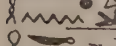
" " to adore

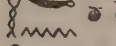
" to supplicate

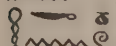
hekennu, to prepare for embalming


hekuu " " " " "


hekuu, to offer praise, to welcome, to adore


hekuu, an anointing oil, to anoint

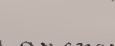

hekuuu, a discourse

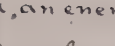

hekuu, one of the 7 offering oils

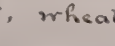
heku, a snare, a net

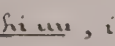
hek, to give laws, rules, to pronounce magical formulas, magical writings

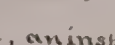
hk, hnw

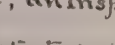

hek t, to give laws, rules, to pronounce magical formulas, magical writings

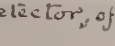

hek, to rule, to govern, to direct


hekennu, to be hungry

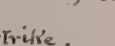

heker, hunger, to be hungry

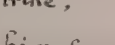

heker, hunger, starve, famish

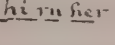

heker " " "


heker " " "

hekeraa, hunger, to be hungry

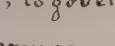

hekes, a kind of antelope

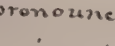

hek t, beer

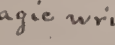

" "

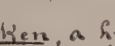
" "

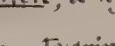
" "

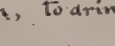

"

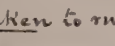

hekt, a frog

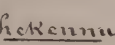

hek t, a queen

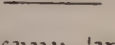

hekaa, the faculty of -

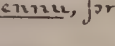

hekau, magic, a charm

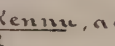

hekek " "

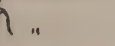

hek " "

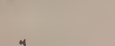

hek " "


hek t " "


hek t " "

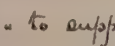

heku, to drink beer

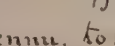

hema, hemp

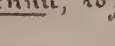

hema, "

hemka, jasper

hemka t, "


hemem part of a plant


hemau, an external malady


hemaui t, salt

hemamit, salt

hm, hn

 hma, salt

hemak, to tie, bind, attach, connect

hemakka, a dark red gem

hemak, an open appartinent

hemú, flax.

hemit, salt

hamu, a sweet scented plant

hemt, please

hemen, number eighty, № 80

hem, to mount, to go towards

hems, to sit, some kind of offering

hemt, a jackall

hen, to rule, to clasp

han, to rule, majesty

hen, a ring

hna, with, and, by means of,

hna tut, 'and a word'; it is the title of a new paragraph, or separate notice, in hieroglyphic writing, also a special communication

henbu, to add

henbit, territory

henbu, to take, to carry away

henbi, a source

hi er ru her, a struggle, to drag

heneb, to take, to carry away

heneb, to cultivate the soil, agriculture

henbt, cultivable soil

henekt, a gift, a donation

henk, beer, (hak, nasalised)

hn

henk, to take, to seize, a captive

 henkt, a gift

 henennut, fruit, scent

hennu, to adore, to order

 hent, utensils or tools for any craft, mason, soldier or priest &c

 henteh, ardea Nycticorax

 hanuh, a sickly condition

 han, to fill, to be full

 hant, to strike, to repulse

 hant, a mistress, a priestess, a regent:

 hent " " "

 hent, consecration, to consecrate

 hennut, rites

 henti, a vase

 han, to rule

 henbt, a fountain

 hent, to rule

 hen w, the limbs

hen, to adore, address, to speak, call

hen, to repulse, force back, retrograde

hennu, duties, fulfill, charges, administer, furnish

 hennu, " " " " " "

 hen, that which is not right, opposed to good, reprehensible, forbidden.

 henti " " " " " " " "

 hani, a surveyor, a geometrician

 heni, a lance

 henb, cultivable soil

 henk, the balance, the scales

 henki t, the tomb

hnw

henki, carpets

heni, to move

henkesk, the throat

henkset, a lock of hair, braid

henksti, mane

henku, a balance, a jar

hen, to block, to cumber a road

hen, careful

hen, envy, malice

hen, a vase

hen, a cycle of 120 years

hankt, a territory, a wall

hen hen, to turn back

hen hen, to return, to agitate

hen, the barge of Socharis

henen, a phallus

henen, a peasant. to till the soil

hannu, indecent language, falsehood

hannu, to till the soil.

hannu, whatever you please

hannui, agriculturist agricultural work

hennu, a young girl

hennu, a vase

hennu, to fill, to be full

hanen, a hoe

hanenu, hoed, to hoe

henenu, to move

henenu, a surveyor, geometrician

hens, narrow, close

hensit, the hair

hent, a lake

hyp. hr, hs

henlau, a lizard

henti, a pair of horns

hent, furniture, house garnish

henti, to cut, to slice, to immolate

henti, a cycle of 120 years

henek, to take, to carry away

han, a crown

hent, to strike to repulse

henen, to cut, to slice, to immolate

hasp, a duck of the Nile

Hapi, The Bull Apis

hesek, the post of danger

hesek, to extend the arms in adoration

hapu, to retrograde

hesperer, to circulate, to wander about

hept, to embrace, an armful, to fix one's self

hept, to hold, to hold together, to stick

her, to go, to leave, to fly, to finish

her, a road

herer, a serpent of Hades

her, and

herhu, an intestinal worm

henu, to repel by a glance of the eye

hes, to please, to obey

hes, to strike, to pierce, to paralyse with a glance of the eye

hes, obedient

hes a I sing, I praise

hes, to sing

hes " "

hes, to strike, pierce, paralyse with the eye

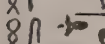
hesi, to pass, traverse. go through

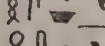
hes, " " "

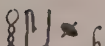
hes

, hesi, to sing, to play upon an instrument, to celebrate, praise, applaud, command, demand, want.

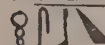
hes, excrement

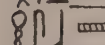
 hesa, the arms and the legs

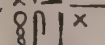
 hes, to sing, to play on an instrument to celebrate, praise, applaud, to command, demand, to want

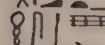
 heseb, to estimate, meditate, think, to calculate, to converse

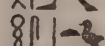
heseb " " " " " "

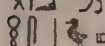
 heseb, to skin, peel, scrape, cut

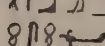
 heseb, a kind of mosaic

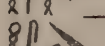
 heseb t, a rope

 heseb, a vineyard

 heseblu, porcelain

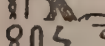
 hesebu "

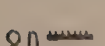
 hesh, to order

 heseh, to cut, to decapitate

hesm, a wild beast of Palestine

hesmi, the left

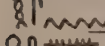
 hesmaa, natrona, mineral alkali.

 hesmen " " " "

hesmen, purify, purge, menstruate

hesment, " " "

hesmenlu " " "

 hesmenlu " " "

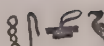
heseb, an agrarian measure

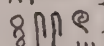
hes, to pierce, to strike

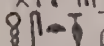
hesau, a liquid used in

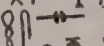
het

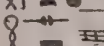
medicine

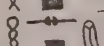
 hesau, a vase

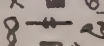
 hesesu, to burn

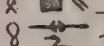
 hes t, a jar

 heses t, "

 hesep, a nome, a district, vineyard

 heseps t " " "

 hespi, a branch

 hes, the sacred heifer (Isis) adored since the time of the old empire

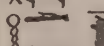
hes, a vase

helebu, to kill, to compel, to force

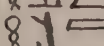
helebu " " "

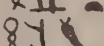
heti, to lie down, to stretch out, to rest

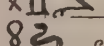
heti, to spread, unfold, extend wings

 helen, an oil jar

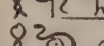
heslem, to strangle

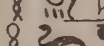
 hesmut, a lioness

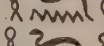
 hetem, to fill

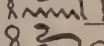
 het, a mace

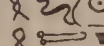
het, oppress

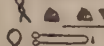
 het, silver or steel

 helennuna, to fast, deprive

 helen helen, " "

 hetet, light

 het, an offering of food

 het, bread

het a kind or quantity of bread

het " " "

heti, the throat

hetera, time, season, a change

het

hti, the throat

hetet, a hyena

hetii, "

hetii "

hetib "

het, impurity, unclean

hetā, to afflict

hlā a kind of food

het, to touch, to consecrate

het, a region, a canal

het, to touch, to consecrate

hetā " "

hetā, a mat, a bed

heti, that which is consumed by friction

heti, the heart the stomach

heti, a lance, a javelin

heti, the white, silver crown of Lo. Egypt

heti, lungs

hetet, the lungs

helāu, to tremble

helāt, the spar or yard of a sail

heteru, the place of annihilation

hetemu, obscure

hetmi "

hetkau, a door

heten, a ring

helēs, net, to catch

heteru, to be obliged to give something, to pay tribute, duty or revenue

helēr " " " " " "

heteri, to be with something, to be

het, hu

attached to - obliged to -

helēs, yeriu, a builders' square or compass

hlār, time

hlār, horse

hlāra, horse

hlār, a horse, an oxteam, a couple

hlār, charge

hlār, tribute

helēs, to fill, to fulfill, to close, to accomplish, to shut

hzii, place of suffocation

heterw, to detail, to give, to attribute

heterw, revenues

helēs, a table, peace

helēs, offerings, food, edibles

helēr, a horse

hutw, onions

hui, to enumerate, to draw up a list

hu, to strike, pluck

hu, a phœnix

hu, wil

hui, "

hu, corn

hu, "

hu, drive

hu, taste

hu. to strike, a delinquent, delinquency

hu, genius, spirit, aliment

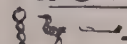
hu, corn, food

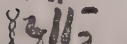
hua, corn ships, boats

hui, light

hw

hua, a stick or cane


hua, a dwarf, buffoon, jester


huit, to tear the hair in sign of grief

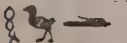
huiui, light

hura, to pillage, to attack with the intent of pillaging

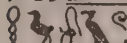
huru, to fail of a thing, want, deprivation, as, want of sleep &c

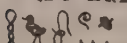
huru " " " " "

huruna, courage

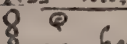

hut, an offering, a table of offerings

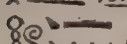
hut, a bundle

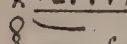

huuaau w, filth, dirt

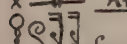

huuau, excrement, filth, fermentation infectious odor, to corrupt a woman

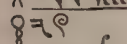
hu, to repair

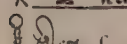

hu, a vow, a desire a wish


hu, substance (of his words)

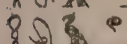

hus, a calf


hu, shins, tibiæ


hut, to grieve

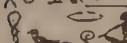

hua, filth, stink

hua, ground to dust

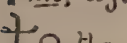

huaau, filth, to soil, to dirty

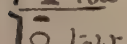
hua hua, filth, dirt

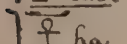
huaa ti, to fly,

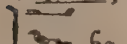

huru, tranquil

hu, a finger or a club,


tba, a seal, to seal


tabt, " "

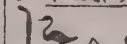

ha, offspring, imprisonment


ha, to imprison

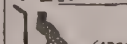
hu

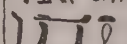
afimer, a beast

hehs, raise


hak, to go, akt, to enter

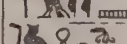
am, cattle


am, in, with, on, cowherds.


hai t, sealed with clay

hami, a gum of the ebony tree, sacred to Anneser

humi, a black gem, hematite


hamkt, the hair

amu, a bludgeon

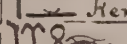
Hemhu, foliage

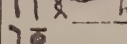
Hemes, an attribute of Ra hawk-headed.

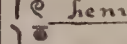
amu, a gentile

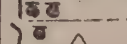
amu, Asiatic

Hem, to find, to discover, to perceive

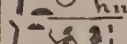

hameh, to see

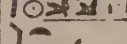

hemu, space, measure

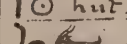

an ointment


to return

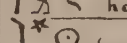
hu t, hour

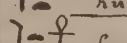

hutu, people of hours, watchers

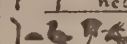

hut, hour

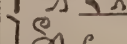

het, a goat

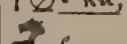
hetu, "

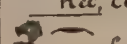

hui, time

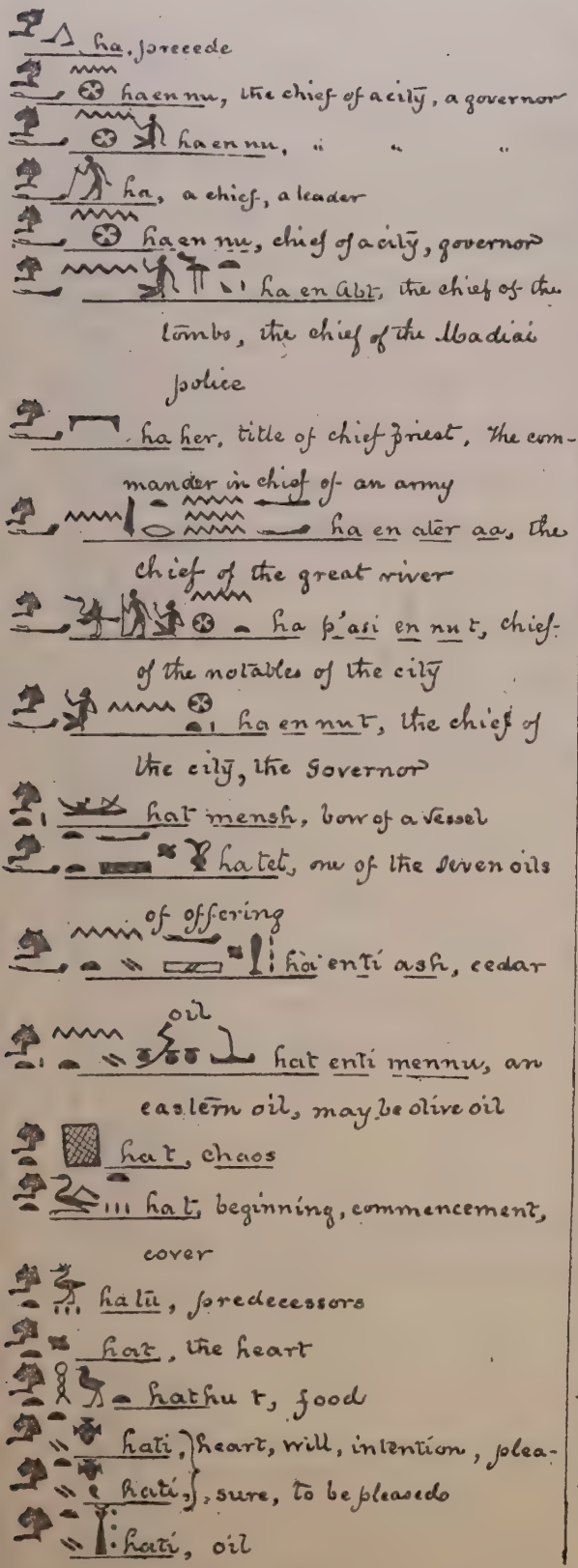

het mmx, a mummy


hetu, a goat, a kid


hu, one half


hee, commence, beginning, essence


ha, heart


ha, foreeede

haennu, the chief of a city, a governor

haennu, " " "

ha, a chief, a leader

haennu, chief of a city, governor

haen Abt, the chief of the tombs, the chief of the Abadiai police

ha her, title of chief priest, the commander in chief of an army

ha en alēr aa, the chief of the great river

ha p'asi en nut, chief of the notables of the city

ha en nut, the chief of the city, the Governor

hat mensh, bow of a vessel

hatet, one of the seven oils of offering

hai enti ash, cedar oil

hat enti mennu, an eastern oil, may be olive oil

hat, chaos

hat, beginning, commencement, cover

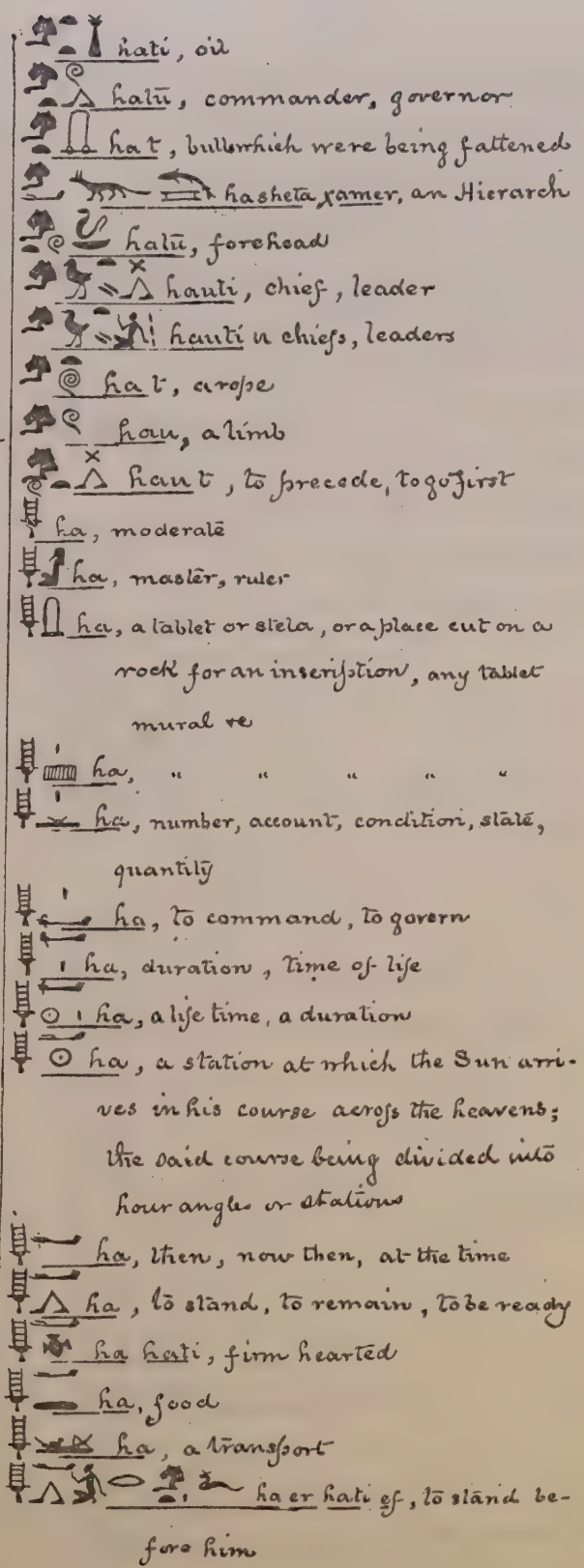
halū, foredeeessors

hat, the heart

hathu t, food

hati, heart, will, intention, pleasure, to be pleased

hati, oil


hati, oil

halū, commander, governor

hat, bull which were being fattened

hasheta xamer, an Hierarch

halū, forehead

hauti, chief, leader

hauti n chiefs, leaders

hat, arose

hau, a limb

haut, to precede, to go first

ha, moderate

ha, master, ruler

ha, a tablet or stela, or a place cut on a rock for an inscription, any tablet mural re

ha, " " " " "

ha, number, account, condition, state, quantity

ha, to command, to govern

ha, duration, time of life

ha, a life time, a duration

ha, a station at which the Sun arrives in his course across the heavens; the said course being divided into hour angles or stations

ha, then, now then, at the time

ha, to stand, to remain, to be ready

ha hati, firm hearted

ha, food

ha, a transport

ha er hati ef, to stand before him

ha, hi

 hath, a vase

 ha, a transport boat

 hi, a stela, a tablet, or surface for inscription

 nemema a wine press

 ha u, magazine, provisions, depot

 ha, a pile, a lot

 ha, a station, a place

 ha, to support, sustain, prop

 ha, " " "

 hai t, the place of rest, the tomb

 hai, a transport boat

 ha, a sacred serpent, a geni

 han, derived from ha, to stand; now then, then; ha en arituu, now then they made –

 ha t, the home of duration, the tomb

 ha t, " " "

 ha t, a large pile, or a heavy weight

 hatu, a tablet

 hau u, tombs

 hau, a kind of shield

 hau, a transport boat

 hau u, stations

 hai, a tablet

 hai, time

 hai, the principal chamber of the tomb, the one where the mummy was deposited

 hi, a tablet, a stela

 hi, " "

 hi, an image, a likeness

 hekt, to exult, to rejoice

 het, crown

ha

 het, hard, stiff

 ha xas, "of the two stools", title of an official; Pharoah and his queen had seats carried about for them by an official of this title

 ha shet, title of an official, Master of the wardrobe; ha shet neb t. accountant of all the breech cloths

 ha, head, over, on, behind, North: in telling the cardinal points the Egyptians faced to the southward - resh, the South

 ha, behind, an ambush, back chamber

 hau, the limbs; ha, augment

 hai, war, discord

 ha, to sack, to ruin, to destroy

 ha, light

 ha, back of head, behind, to turn the head (face) away from, to neglect, negligent

 hau, " " " " " "

 ha, front, dwelling

 ha, a kind of vegetable or seed

 ha, dust, stink, filth

 ha, besides, bask

 haabti, to jeer, to mock

 haaui, to lie in wait, to watch

 haai, war, discord

 hai, to cry, to lament

 hai, rain

 haau, anger

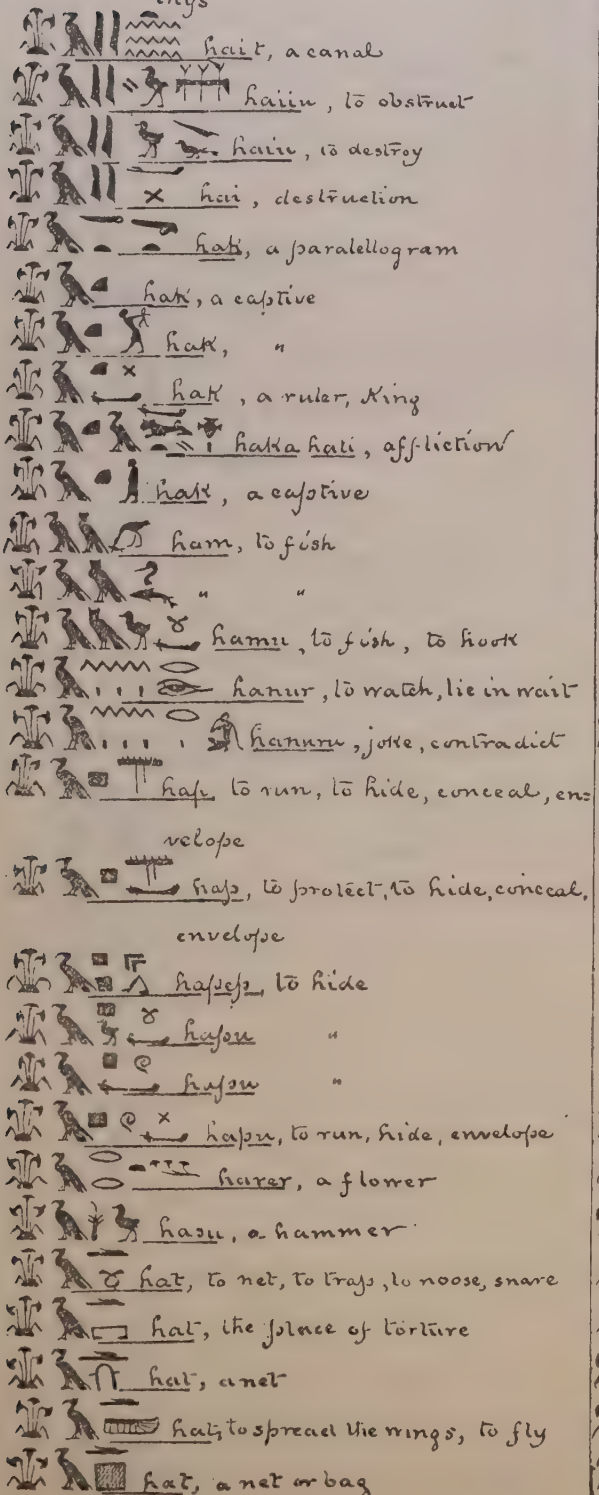
 haat, spouse

 hai, to give light, to beam

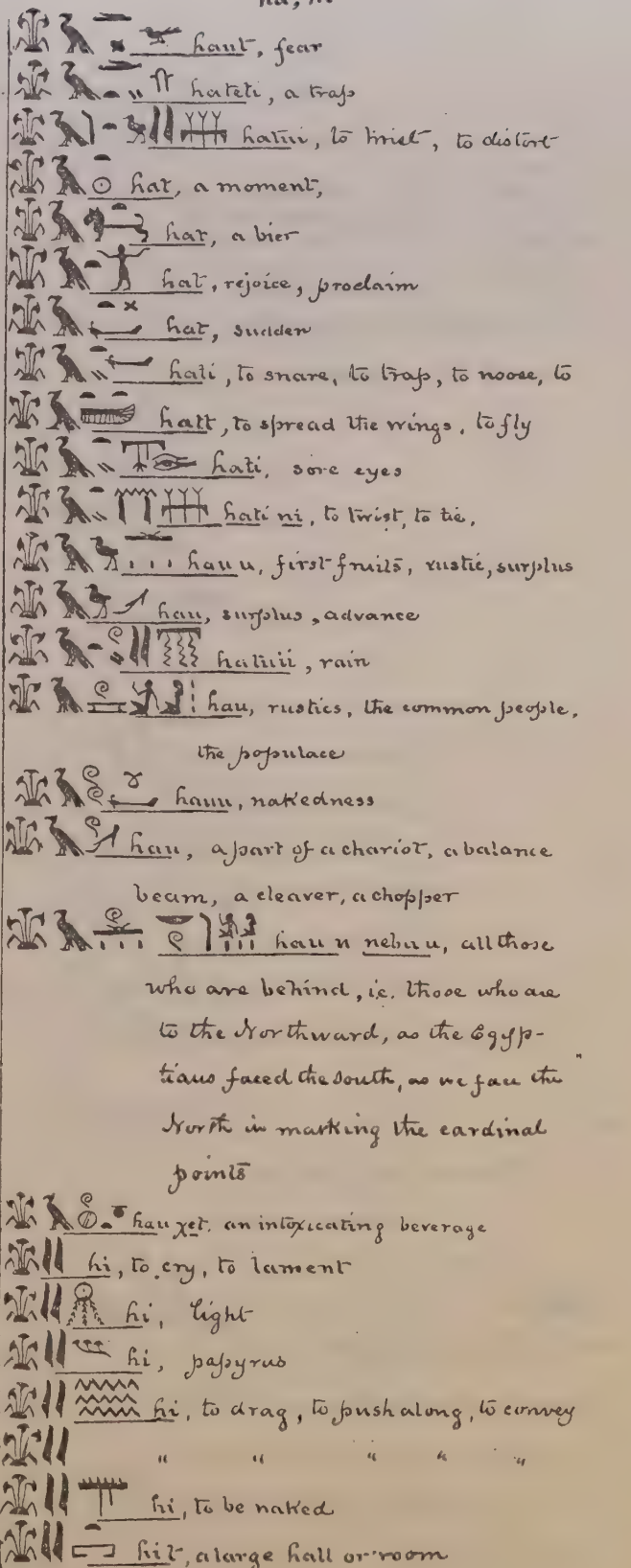
 haiti, women who were hired

ha

to lament at funerals, representing the weeping sisters Isis and Nephthys

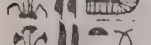


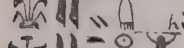
ha, hi

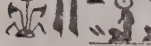

haut, fear
hateti, a trap
hatiu, to twist, to distort
hat, a moment
hat, a bier
hat, rejoice, proclaim
hat, sudden
hati, to snare, to trap, to noose, to
hatt, to spread the wings, to fly
hati, sore eyes
hati ni, to twist, to tie,
hauu, first fruits, rustic, surplus
hau, surplus, advance
haiiii, rain
hau, rustics, the common people, the populace
haun, nakedness
hau, a part of a chariot, a balance beam, a cleaver, a chopper
hau n nebau, all those who are behind, ie. those who are to the Northward, as the Egyptians faced the South, so we face the North in marking the cardinal points
hau xet, an intoxicating beverage
hi, to cry, to lament
hi, light
hi, papyrus
hi, to drag, to push along, to convey
" " " " "
hi, to be naked
hit, a large hall or room

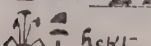
ḥ

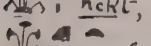
ḥaiu, to fly, to ascend


ḥiti, to set a snare


ḥiti, the two lights, the sun and moon

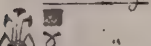

ḥekt, to take, to seize, booty


ḥek, captive

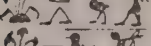

ḥaḳ, to hide

" "

ḥaḳlū, a spy

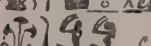

ḥeḳu, "

ḥesḳ, an ingredient of perfume


ḥaā, to cry, to lament

ḥaāui, rain

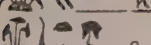
ḥati, affliction

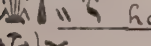

ḥati, a pair of bellows.

ḥaā, a knot, to tie

ḥatiu, knots, ties

ḥau, an achiff, a man


ḥauṯ, a spy, a deserter


ḥu, more, how, besides

a serpent

ḥauu, augmentation, increase, growth

" " " "

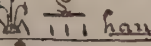
ḥa, corn

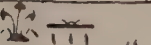
ḥa, ah! oh!

ḥa, time o'day

ḥa, time, period, epoch

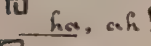
ḥa, Ah! Oh! hail!

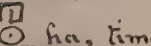

ḥa, before


ḥa, husband

ḥa, come forth

ḥa, a goose, a duck


ḥa, oh! ah! hail!

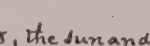

ḥa, husband, man, male

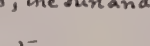
ḥa

ḥauk, a reptile

ḥa, the hailer

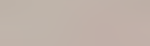
ḥa, a husband


ḥa, to proceed, to enter;


ṯuḳ ḥer ḥa en eḳ en sen, thou will't proceed with them, i.e. thou will't agree or arrange with them.

ḥa, a duck

ḥa, daytime

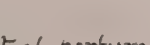

ḥa, oh! ah! ha! hail!

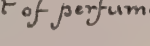
ḥaa, precept, order, instruction

ḥaa ṯ, a cow

ḥab, cook

ḥab, a plough, to plough


ḥab, to run on a road, messenger, run

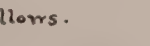

ḥabu, a watering place

ḥabu, an ibis

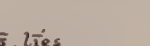
ḥabu, to send, to haunt

ḥaserṯ, an armlet.

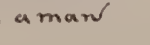
ḥai, ha! oh! hail!


ḥai, ha! oh! hail!, to address, to invoke

ḥai ti, entrance, door, portal, one of the principal rooms in a palace, a ceiling


ḥai, to proceed, to enter, to fall

ḥai, a cry, an invocation,


ḥai enti ḥeḳen nu em Ra neṯer ḥer aṯeṯu en mesen beṯeṯ; cry of exultation of the God Ra when he clove the heads of the evil ones (or rebels)

hi, hes

hai, send, fall, descend, throw, proffer, entreat

hai, to go back, to return, to fall into

hai, one of the feline species

hai, husband, man, male

hai t, entrance, door, chief room, ceiling

" " " " "

hai, add to

hainnu, a well, a wave

hainu, to utter cries of joy

haii, sloping, descending

hairu, an artificial pond or fish pond

hamu, to give orders

hamiu, sin, deformity, uncleanness

han, acquaint, order, return

han, to accede

hana, Oh! Oh mercy! please!

han, to approve, to draw, to attract, that which attracts

hanen " " " " "

hannu, a vase

hannu, a lake, a sheet of water

hapu u, laws

" "

har, a kid

haru, an act of violence

haru, a jar

hart a colt, a kid

har, a basin, a pond

harululā, sweetness

hasekhalā, to hasten, drive

hasmenen, natron a

ha, hb

 has t, a kind of drink

 hat, to revere, fear, scare, to assemble, to hurry, rush,

 halemu, to assemble

 hath, to frighten, to scare, to be terrible, to revere, to be afraid

 halā halā, to hurry, to assemble

 hat, a fever

 hates, hell

 hat, to cast down, overthrow

 hati, " " "

 han, the one who has fallen, lost, ruined

 han u, defiles

 han, time, epoch

 " " "

 han u, a heap

 hau, to fall on, descend on

 haut, fire

 han u, legal proceedings, lawsuit

 hani u, entrance, door, pylon, one of the principal rooms of a palace, the ceiling

 hauni, to fail

 hanana, a fish

 haur, to resist

 hab, to run, to run on a road, to send a message, messenger, courier

 hab, an ibis

 hab, mourning, distress, torment

 hab, plough

 hab, to send, a messenger

 haba, to send

 habhab, to beset, to prowl

 habhab, to hunt, to wander about

hunting

habhab, to drive away pain

habek, a paddock

habek, to diminish, weaken, wither

" " " "

hebeni, ebony wood

heben " "

" ebony tree

hebent, a liquid measure

" hebnir, a collar

heben.t, honey

hebent, a honey jar

heb.t, a rule

heby, to go around

heh, scorch, hot blast

heh, heaven, sky, ceiling

heh.t, " " "

heh, a disease of the ear

heh, to tumble, to fall, to omit

heka, to seek

hi, oh! oh! hail!

hi.t, the ceiling, overhead

hi.t, " " "

hi, ah, oh, hail!

hi, " " "

hi, a ram

hi, destroy, wound, offend

hi, room in a tomb, a passage

hin, beside, near, neighbor, join, touch

hini " " " "

hini, house or property which has been owned by a family for centuries

hin, land, city, or house which has been owned by a family for centuries

hak, a festival, a period or time

haker, a feast, a festival

" " "

haker, a fast

haker, a vigil (applied to a festival)

" " " "

" " " "

hek, disappearance

hakti, a period, a season

hamham, to roar

hamham tu, provisions

hi, destroy, wound, offend

hamham, to roar

hamhamu, arrogance, petulance, impudence

hamhamti, the two roaring vipers, symbols of the evil passions

hammu, human beings

hemes, to bow or incline as a mark of respect

hemes, " " " " " "

hamhamtu, roars

han, a vase

han, a measure, Litre 0.455

han, to adore

han, to assent, to favor

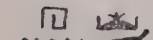
han, psalpitale

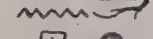
han, a vase

han, a box, a coffin

han, a box.

hw, hs

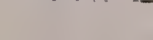
 han, a box

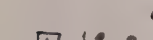
 han, the cranium

haw, to draw, to attract, that which attracts, to approve

han, neighbor, friend, associate

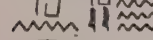
hanhit, a pool

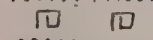
 hanhan, to consent, to accede to, to will, to acquiesce

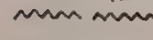
 hanen, to approve

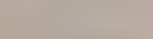
hanen, a deer, a stag

han, nod assent

 hanen, a penis

 hanen, to please

 hannuh, an animal

 hannu, to send for-

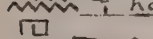
hannu, a quarry

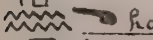
hannu, a measuring vase, a hin, 5 litres

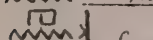
hannu, a well

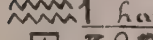
" "

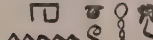
hannu, exclaim, address, adore

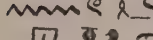
 " " " "

 han, adore

 " "

 han, a liquid measure

 hant, a jar

 hap, to tie, to attach, to judge, a judgment, a sentence, a law; a statute

hap-w " " " " " "

hapsu " " " " " "

hap " " " " " "

hru en sha, day of the rising,

hr

or appearing; when the extra mural processions took place, with great pomp, from the temples

 har, a vase

 har, a basin, a pond

 her, repose, quiet, calm

 har aat, the great procession, the extra mural procession

 hru, day, time, hour

 har, pride, pleasure

 har, a field

 heri, on, in; heri kabek, in thy bowels.

 heri, misfortune

 heri, stomach

 heri, to sleep

 herst, to moisten, to dip, to float

 herst " " "

 herpu " " "

 herert, please; herer, a plant

 hertu, delighted

 hru, neglect

 hru, day; hru en Kar, the day of battle,

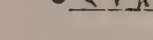
 heru, besides, furthermore

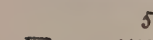
 heru, " "

 herui t, an official record, register, annal

 hru, besides

 hrut to arm for war

 has, opprobrium, scandal

 hashas, fire, to burn

hat, to terrify

ht

hat, to terrify

halnu, a footstool

hatha to repulse

hathat "

hat-pu, an architrave, a stone for building

hat, a public building

hata, a title of the old empire

hatu, to bore, to pierce

heti, ceiling

hethet, to hoe, to cultivate

hethet, inundation

hethet, require, ought

het, an entrance, a door, a pylon, one of the principal rooms of a palace

hati, to reverence, salute, adore

hatu, adoration, salutation

hat-talu, salutation

halu, cynocephalus, adoration

halu, ought, should

hatut, salute

hu, to be afraid, fear

hut, " "

hui, a wild beast

hu, a day

hu "

hui, to rejoice

hat, a temple, a residence

hat, a stable for cattle

hat a stable for calves

hat a stable for sheep

ha, a palace

hi to drag, to smite,

hn, hk, hm

hau, to drag. id.

hiu, to lament

hab, a workshop

hab, workshop, store, temple storehouse

haben, ebony tree

haben, ebony

habrer, to run away, to carry off

haben, ebony tree

hek, ruler, king, to rule, govern

hebsi, to reckon

hek, to rule, to govern, to direct

hek, a queen, regent, ruler

hek, a ruler, a king

hek " "

hek " "

hek, a mountain goat

hek aut, a goat

hekw, beasts

hem, woman, wife, seat, place

tahesti, copper, bronze

ham, to fish

hembn, a substance

hemi, a cow, a wife

hem, wife, lady, saddle

hem, to turn back, to repulse

hem " " "

hem, a confusion

hem, "

hem, a saddle, steering oar

hemi, " " "

hem, to look, to see

hemi, to steer

hem, to fish

hm, hs

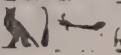
hemu, to fish

hem "

hem, a paddle, a steering oar

hemsa, the back, an amulet

hemem, turn back, repulse, drive away


hemtā, to tie together by the neck

hem, to sit, to rest

hem, a female

hem, to cut to pieces, to annihilate

hem, harem

hem t, wife

hema, wife, woman

hemem, to repulse, force back

hemrw, a seat, throne, stairs

hemer " " "

hemer, all, every, each

hemerw, " " "

her, to alarm to terrify

hems, to sit, to be occupied with, to sit

hemt, a man woman, a debauchee, an effeminate, an infamous man

hemti, that which is forbidden, that which is reprehensible, evil

hems, to sit, to rest, to be occupied with,

hems hati, quiet hearted, content, pleasure, will, intention

hems, to sit, to rest, to be occupied with

hems, " " " "

hems, " " " "

hemt, a wife

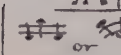
hemt, uterus, matrix, womb

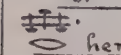
hemti, the forbidden, the reprehensible

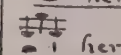
haut u, fields

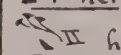
hn

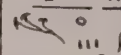
hantī, laborers of the fields


or , malēnu, a road, a path

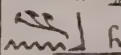

her, with the exception of-

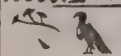

hert, circumference, space around


han, a field; uti, farmer,


hanu, a kind of grain

hanti, laborers

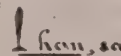

han, to return


han, field laborer

hanuti, to till the earth, a peasant

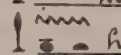
hanuti, culture, cultivate, cultivation

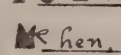
hn

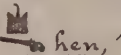

han, sacred, divine

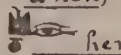
hanu, slaves

hanef, his holiness, his Majesty

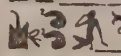

han t, a priest

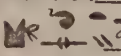

hen, a duty, to be charged with -, to fulfil, to administrate, to furnish

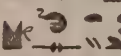

hen, to command

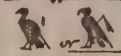

hen, to see, look

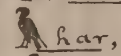
henti, a pair of horns

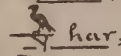

henkek, to be overjoyed, rejoice

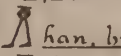

henkesti, a lock of hair, braids

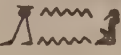

henkesti, a woman with braided hair

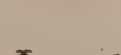

Har, Horus; Har ab shet, planet Jupiter


har, ten, 10, equal to ∩; Saturn


har, holiness, majesty Har en ti Mars


han, bring, conduct, bring tribute


Hanen, the Bringer, the name of a god


hannau, convoy, guard

hannu, tribute, spoils, plunder

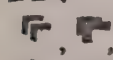
hannu, " " "

hannu, imports

haw, bring

hannw tribute

hannw "

 kenb, a corner, an angle,

hepet, a square, a right angle

" " "

hafe, a paddle

hafe, towun, to walk

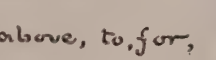
hafe " "

hafet, to paddle a boat

hafehafe, to screen

hafe, a whip

hafti, a cabin, an ark

her, face, visage, on, above, to, for, towards, by, from, as much as, out of, at the-  tat a em her ef. I present to him

her " " " "

" " " "

her, all, all others

her, Chief, superior, watcher, guardian

her " " " "

heri " " " "

her " " " "

her " " " "

her ef, he himself

her, guardian, chief, superior

her t, an image, a likeness

her- the large hall situated in front of the sanctuary of a temple

hernu, the body, an image, a statue

her, intimacy, love, affection, please

her

hert nu, deposit of inundation, slime

her hati hru, the middle of the day, noon

herhati, delight

her aa en-, governor of-

heru, face

heru nebu, face of all, in the presence of mankind

 her tut, forthwith

 heri ru ba, at the door of the furnace

 heri, rudder, skeleton, rigging of a vessel

 herii, to exceed

 heru hauk, a plant

 her, a flower

 herefexet, a kind of goose

 herefxetner, " " "

 heri, above, superior

 her, go, leave, fly

 hera, neglect

 hek, aion, age, many days

 her, to terrify

 her, above, upon

 her, calf's head, seal

 hehax, name of a festival

 her hati, in the midst, in the-

 herenti am, as much as is in-

 herent, inside of the body

 her nuit, besides, above

 hert, go along

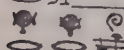
 hert, a park

 hru, a day

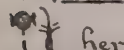
 hrutu, to polish stone

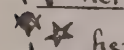
her

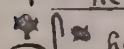
herw, besides, moreover, beyond

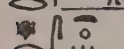
 her herw, to expand, to dilate with joy.

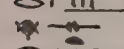
her sa after

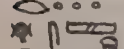
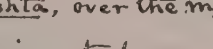
 her sa after

 her ḥnat, dwelling in

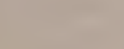
 hers impurity

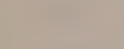
 hers ṯu, a precious stone

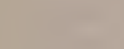
 " " " "

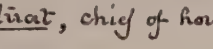
 her seshtā, over the mysteries, a title given to persons of learning, acquainted with the mysteries of literature, secretarys;  her en Joer ḥnat, chief of house of astronomy.

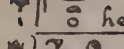
hesr t, a precious stone

 her tā, upon

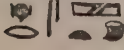
 ḥnī, miserable, polluted

 ḥnī, filth

 her seshtā en neter xerw, superior of the mysteries of the sacred writings; the highest rank of the priesthood

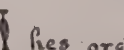
 her sa nen, after that

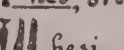
her aset kaṯī shentī. superintendent of the works inside of the palace, a title of a very high rank, a personage attached to the suite of Pharoah

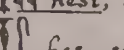
 herṯu, pieces of wood laid along across the timbers to strengthen a vessel.

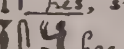
hes, het

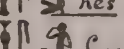
heri, pieces of wood laid across the timbers to strengthen a vessel

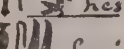
 hes, order, obey

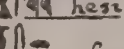
 hesi, subject, order

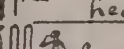
 hes, sing, singer

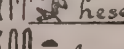
 hes, subject

 hes, sing, will

 hesi, order

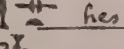
 hes t, a jar

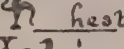
 heses, sing, will

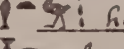
 heses t, order

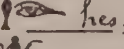
heses, to sing, to will

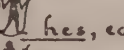
heses t " "

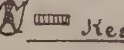
 hest, fresh

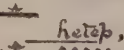
 heṯū u, benefits, gifts, favors

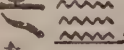
 hes, vex, enrage

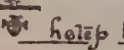
 hes, captives

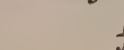
 hes, alabaster

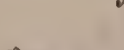
 heṯep, a table

 heṯep, ?

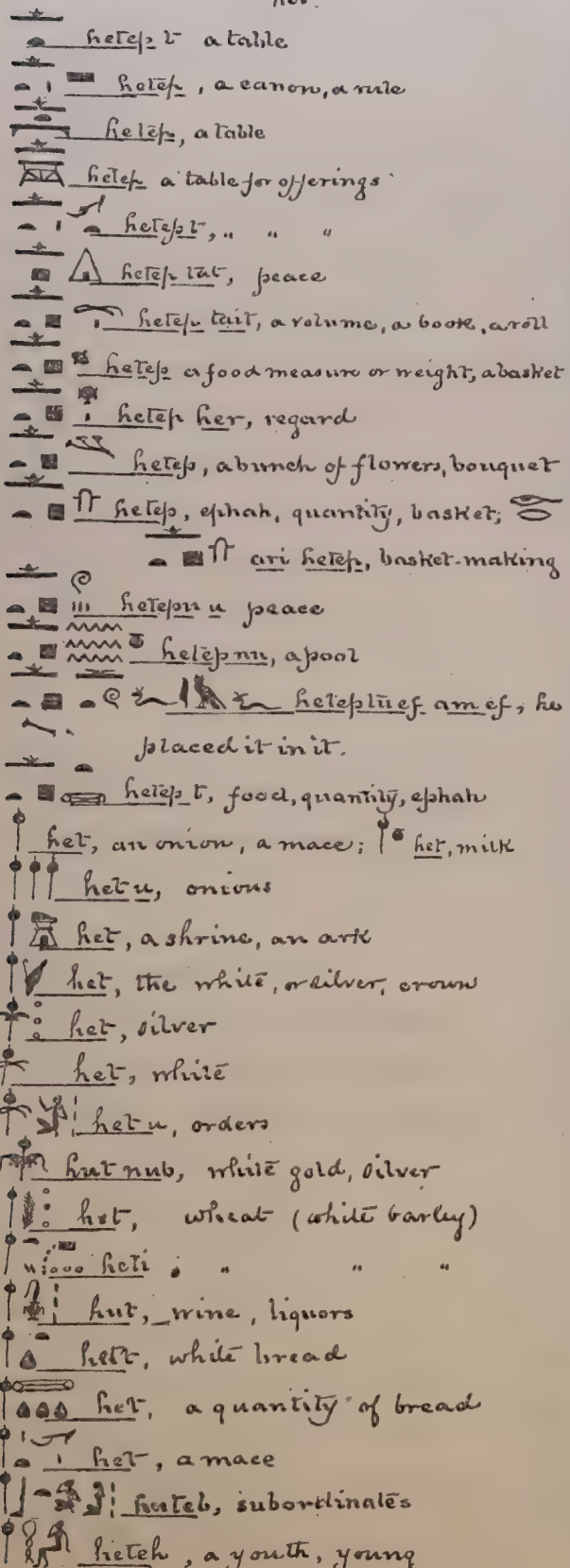
 heṯep hati, a propitiatory offering, satisfied with an offering, to conciliate, to propitiate, peace

 heṯepi hati " " " " " "

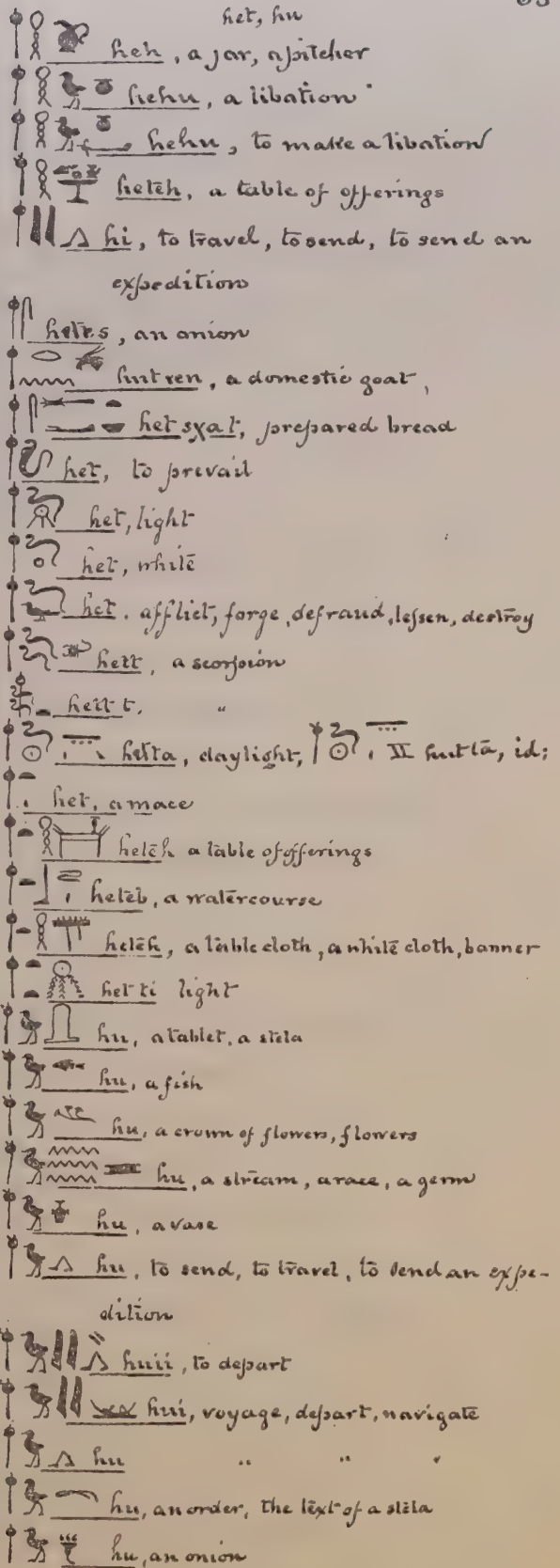
 heṯep, food, an offering, the revenues of a temple

 hetsen, a quantity of bread, offerings

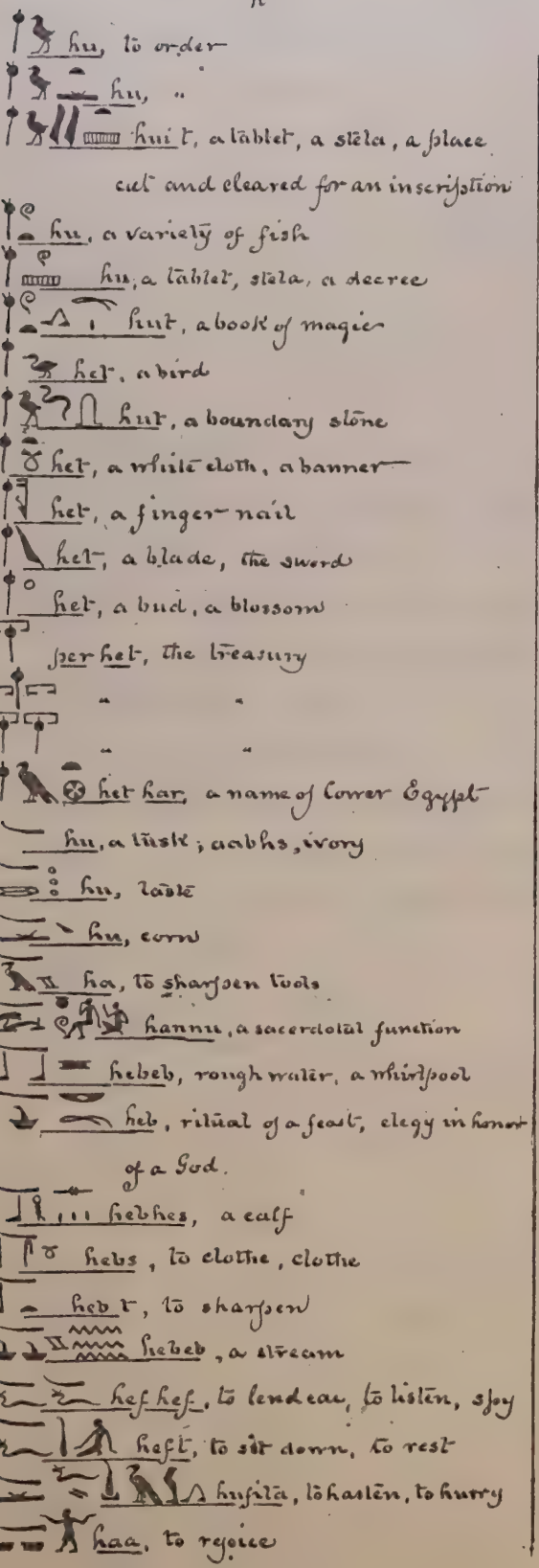
heṯep, food; quantity, peace, welcome sunset, ephah, shrine, table, heaps of food, offerings, unite, assemble, restored to peace, eatables, products of the soil


heteṗ t a table
heteṗ, a canon, a rule
heteṗ, a table
heteṗ a table for offerings
heteṗt, " " "
heteṗ tat, peace
heteṗ tait, a volume, a book, a roll
heteṗ a food measure or weight, a basket
heteṗ her, regard
heteṗ, a bunch of flowers, bouquet
heteṗ, ephah, quantity, basket;
ari heteṗ, basket-making
heteṗ u peace
heteṗnu, a pool
heteṗtuef amef, he placed it in it.
heteṗt, food, quantity, ephah
het, an onion, a mace; het, milk
het u, onions
het, a shrine, an arc
het, the white, or silver, crown
het, silver
het, white
het u, orders
hut nub, white gold, silver
het, wheat (white barley)
heti " " "
hut, wine, liquors
het, white bread
het, a quantity of bread
het, a mace
hateb, subordinates
heteh, a youth, young

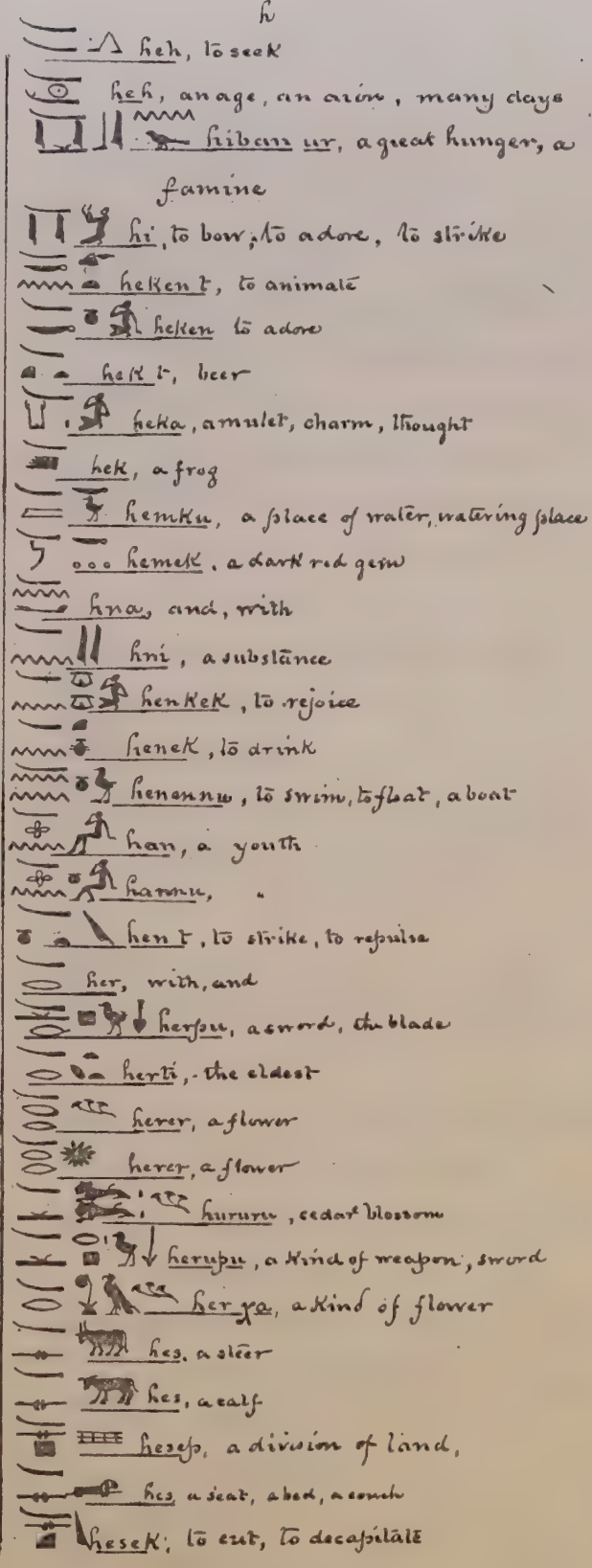
het, hu


heh, a jar, a pitcher
hehu, a libation
hehu, to make a libation
heteh, a table of offerings
hi, to travel, to send, to send an expedition
hetes, an onion
hutren, a domestic goat,
het sxat, prepared bread
het, to prevail
het, light
het, while
het, afflict, forge, defraud, lessen, destroy
hett, a scorpion
hett t, "
hetta, daylight, II hutta, id;
het, a mace
heteh a table of offerings
heteb, a watercourse
heteh, a table cloth, a white cloth, banner
het ti light
hu, a tablet, a stela
hu, a fish
hu, a crown of flowers, flowers
hu, a stream, a race, a germ
hu, a vase
hu, to send, to travel, to send an expedition
huii, to depart
hui, voyage, depart, navigate
hu " " "
hu, an order, the text of a stela
hu, an onion

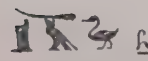
h


hu, to order
hu, "
hui t, a tablet, a stela, a place cut and cleared for an inscription
hu, a variety of fish
hu, a tablet, stela, a decree
hut, a book of magic
het, a bird
hut, a boundary stone
het, a white cloth, a banner
het, a finger-nail
het, a blade, the sword
het, a bud, a blossom
per het, the treasury
" "
" "
het har, a name of Lower Egypt
hu, a tusk; aabhs, ivory
hu, table
hu, corn
ha, to sharpen tools
hannu, a sacerdotal function
hebeb, rough water, a whirlpool
heb, ritual of a feast, elegy in honour of a God.
hebhes, a calf
hebs, to clothe, clothe
heb t, to sharpen
hebeb, a stream
hef hef, to lend ear, to listen, joy
hefi, to sit down, to rest
hufila, to hasten, to hurry
haa, to rejoice

h


heh, to seek
heh, an age, an aion, many days
hiban ur, a great hunger, a famine
hi, to bow, to adore, to strike
heken t, to animate
heken to adore
hek t, beer
heka, amulet, charm, thought
hek, a frog
hemku, a place of water, watering place
hemek, a dark red gem
hna, and, with
hni, a substance
henkek, to rejoice
henek, to drink
henennu, to swim, to float, a boat
han, a youth
hannu, "
hen t, to strike, to repulse
her, with, and
herpu, a sword, the blade
herti, the eldest
herer, a flower
herer, a flower
hururu, cedar blossom
herupu, a kind of weapon, sword
her ya, a kind of flower
hes, a steer
hes, a calf
heseb, a division of land,
hes a seat, a bed, a couch
heseK, to cut, to decapitate

h


haem, to strangle

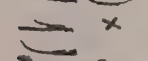
hat, throne boat

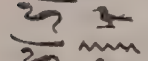
hat, a seat, a bed

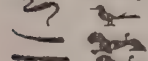
hut, a region

het t, a table of offerings, offering

hetu, a throne


heteq, to join, to rejoin


hut, smite injure


hutien " "

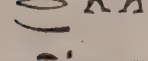
hutaiu, to roar

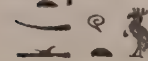
hetu, to polish a stone, to gild re

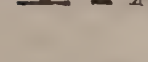
hetem, to fill

hetet, to spread the wings, fly

heter, to be attached to, obliged to.

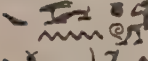

hetet, twins


het, the tongue

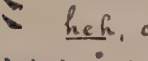

hutu, subaltern officers who oversee duty, while the sergeants have charge of expediting it

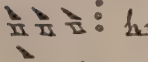
hu, drag

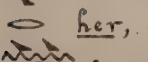
hubet, a leaf, a flower

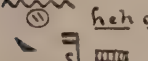

hannu, a youth

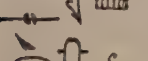
hufitu, to speed, to hasten

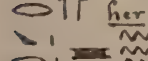

heh, age, aion, many, time

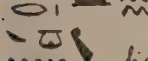

hau, day


her, and, with,


heh ensef, many times, innumerable times

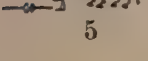

Kes, an engraven stone


her, to fear, to lie in wait

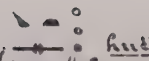

huru, a tank

hieken, a hymn

humuu, a flower

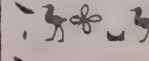

hesu, a slaer

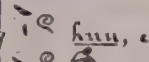
h

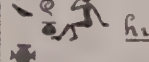

hutu, a precious metal

hefsek, to extend the arms in adoration

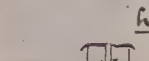
huuut, rejected


huatiu, progeny


huu, edge, limit


huuu youth.

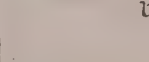
hati, the heart, the stomach; hati amu t, a heart dilated (with joy).

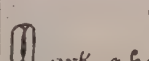

heb, a festival, a religious feast, an elegy in honor of a God, a panegyric

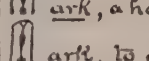
heb u nu shuu. festivals within the temples, intra mural feasts or festivals

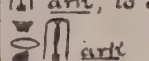
ark, a hall, meeting chamber, reunion hall

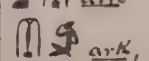
arkt, to complete a building

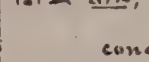

arkt " " "

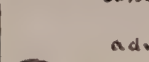

ark, reason, motive, opinion, intention, conclusion, idea, knowledge, support, advice, design, deliberation

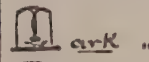

ark " " " " " " " "

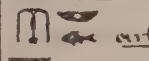

ark heb, fishing, drawing nets


hebs, ritual of a festival, elegy in honor of a God.

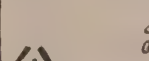

hefet, seven; han, to encircle, to hold together

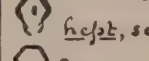

hemt, uterus, matrix, womb


han, a body servant, or a servant employed in the care of the monuments


heseb, to estimate, meditate, think, calculate, calculation, converse

hebsu, miners, the workers in the gold mines


hebs, an account


hebs, " "

h, i

hebs, wheat

Ka, to punish

Ka, weavers

shen, brother

hebsmat, a pure garment, linen

shen, a million

shenti " attendant

hebsa, a kind of linen

sas, a kind of stone

sas, " "

sasaw, darts

sasi, arrows

Kasenw, a green stone

Kasjew, jasper

sasr, an arrow

susrw " "

sas " "

hulēb, a watercourse

I

i, at the end of a word, gives the radical the form and value of an adjective

i, gives the dual sense to a word

i, a house, a place

i t, " "

i, color

i, come, go

ai t, come, go, arrive, become

ai t, heaven, the sky

aia, yes,

aia, yes, I can, certainly, assuredly

aiā, assuredly, yes, certainly

i

iä, to wash

iä "

ia "

ia "

ih, a nosegay

aim, a tree

ima, the sea, the Nile

ima " "

im " "

iaax, why? how?

imbu, juice, liquor

imr, a jar

isiru, leaves or plants

ir, paint, a likeness, a figure

ir, a palace

iri, a boat

irāy, a potter

iuma, the sea

" " "

iura, beans

istiti, to tremble, a prisoner

ir, embalmment

iu, house

iua, boat

ibt, the East

iu, going out, coming in

K

ek, the affix of the 2nd person, masc: sing: thou, thee

Ka, say, call, name, design, yes then, certainly

Ka, faint, envy

Ka, base

Ka, boat transport

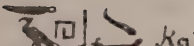
Kafir, village

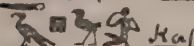
Kairi, goat

Ka, a bull

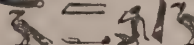
Kai ru, cows

Kaha, to beat, to strike, a blow to oppose, to rush, to encumber, an obstacle, to resist


Kaheb, to strike, to butt, to toss

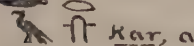

Kasu, mystery, mysterious

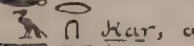
Kamaru, a camel

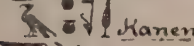

Kamaaru, a camel

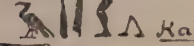
Kamahu, an Asiatic pastry

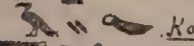
Kamen, blind, obscured


Kar, area

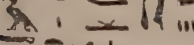

Kar, a curve


Kanen, a plant, (cinnamon tree?)

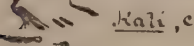

Kalā, to shove, to strike

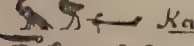

Kali, a cauldron

Kalī, "


Karuhulā, a fig measure

Kati u, multitude, crew, workmen


Kati, cows


Kau, seize

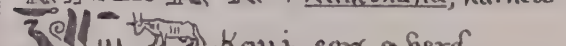
Kau t, the rest, the others, the rabble the crowd, the common people

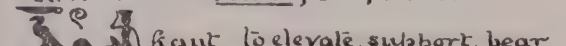
Kani " " "

Kanishena, harness

Kb, Kf. Kh,

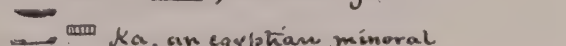
Kantshana, harness


Kani, cow, a herd

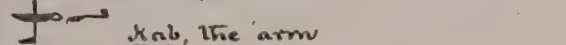

Kant, to elevate, support, bear

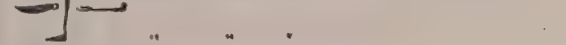
Kant, " " "

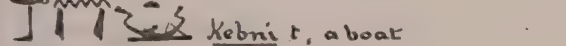
Karu, the land of Kemeroth

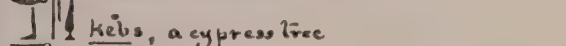

Ka, an egyptian mineral

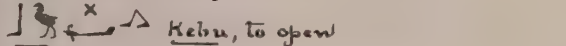
Kak, a worm

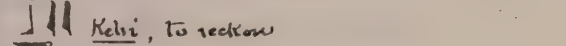

Kab, the arm


" " "

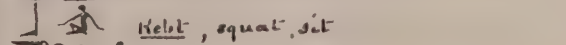

Kebni t, a boat


Kebs, a cypress tree

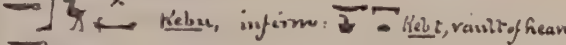

Kebu, to open


Kebi, to reckon

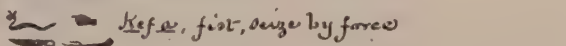
Kebi, give, reckon

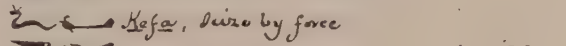

Kebt, squat, sit

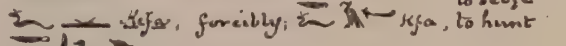
Kebti, the arms

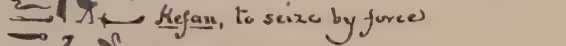

Kebu, infirm: Keb t, vault of heaven

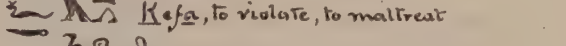
Kef rebel, rebellious

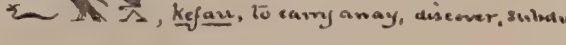

Kefa, fist, seize by force

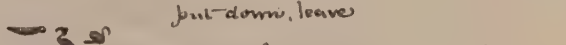

Kefa, seize by force

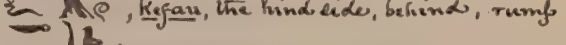

Kefa, forcibly; Kfa, to seize, to hunt

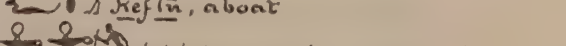

Kefau, to seize by force

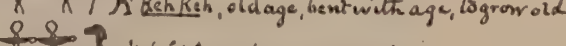

Kefa, to violate, to maltreat

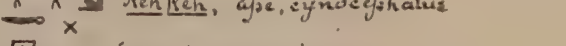

, Kefau, to carry away, discover, subdue, put down, leave

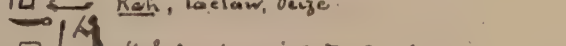

, Kefau, the hind side, behind, rump

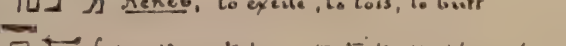

Kefla, a boat


Kehkeh, old age, bent with age, to grow old

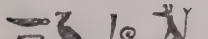

Kehkeh, ape, cynocephalus

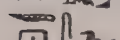

Kah, to claw, seize


Keheb, to excite, to toss, to butt


Keh, a blow, to beat, to strike, to oppose, to resist, to encumber, an obstacle

Kk, Kn


Kehabu, to strike, to rend


Kehas, sorrow, grief

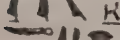
Keh, slow, mild

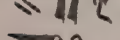
Ki, another, a second one, the other;

Ki tet, "another word" (begins a new paragraph) besides, another matter, another argument.

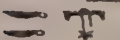
Kiut, a plant

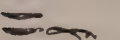
Ki, to cut

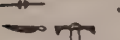

Kii, a manny goat


Kisi, a flower

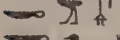
Kek, a boat, caique, darkness


Kek, shade, darkness, obscurity

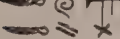

Kekes, bind, entreat

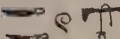

Kek, darkness; Kek, a dried plant

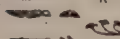
Kekn "


Keknu "

" "


Kekn "

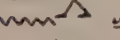

Kemti, a kind of wheat


Kemti-u " " "

Ken, answer, speak

Ken, to accompany

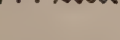
Kenau, idle


Kenatu

Kenuanauru, a guitar

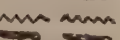
a zither

Keneh, obscurity, to obscure


KenKen, to dance

KenKet, a precious wood

Kenmem, vineyard country


Kenmemti, a cynocephalus

Kenemtā, a locality producing a much esteemed wine

Kn, Kr, Ks

Kenew, vineyard country

Kenen, an ingredient of the Kyphi

Kinenrutā, land of Fenero-tu

Kennu, grease, fat

Kens, a Nubian bow

Kenaa, idle

Kens, bowels

Ken, to answer, to speak

Kefet, the hand, the fist

Kefet, " - "

Kefet, the palm of the hand

Karush tā, bread

Karua, a lake, a pond

Kar, silence, to be silent; to silence

Kart, chest

Kar, fraud, to deceive

Karau, a claw

KerKer, a claw, to seize with a claw, extend, embrace, agitate, beat

Kerer, furnace, censer

" " "

Kerasher, a body of troops

Kersha " "

Kershra " "

Kesm, a sceptre

Kesu, interest, will, pleasure

Kes, to entreat

Kes, abject, subdued

Kes, abject, entreat

Kes, embalmment

Kes, to bind, to subject, to entreat

Kes, to bow, to bend

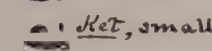
Kesed a tree whose bark and soap were used in medecine

Kesm, to avoid, to turn aside

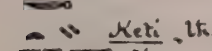
Kes, to prostrate, to entreat

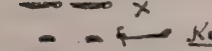
Ket-Ket, to diminish

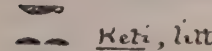
Ket, small, little

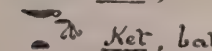

Ket, small

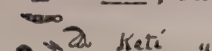
Ket, other


Keti, thou, thy


Ket-Ket, beat, overthrow, shake

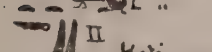

Keti, little

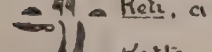

Ket, bald

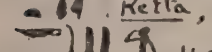

Keti "

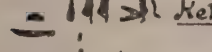
Keti, small, young.

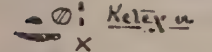
" " "

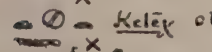

Keti, a cauldron


Ketta, another


Ketti, the rest


Ketexu other

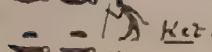

Ketex other, different

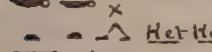

Ketex, other things

Ketxu, the other

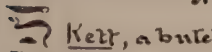
Ketxu, others, other things

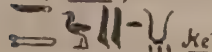
Ket-Ket, an old man


Ket-Ket, to shudder, to tremble


Ketyet, the shaft of a column

Kett, a butcher

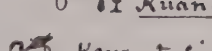

Ketni, a cauldron, a boiler

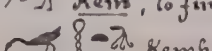

Kua, thou for me

" " " "

Ku, at the beginning of a phrase is an interjection claiming attention, as, Oh ye! hark! re

Kuant, a fig tree


Kem, to find, to invent

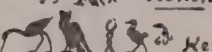

Kemht, a lock of hair

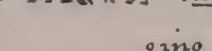
Kem, to find

Kemu, finds, discover, learn, perceive

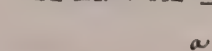
kemh, to look fixedly at -

Kemh, a widow


Kemhu, a certain way of arranging the hair


Kemehsw, a quality of Ra with a hawks head

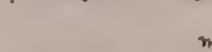
Kemi, a nutritious plant


Kemit, find that.

Kem Kem, to feel, to investigate with the hand, to sound

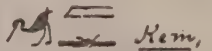
Kemtu, torpor

" " " Kemminiu, a nutritious plant


Kem, to seek, to find

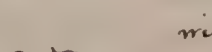
Kemek, to watch, observe, look at -

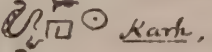
Kem Kem, to feel, to investigate with the hand.

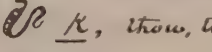

Kerh, night time

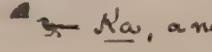
K, thou, thee, thy,

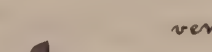
Nu, a negative, no, not, never

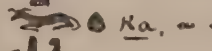

Ka, a kind of food

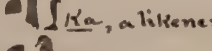

Ka, a likeness, a figure, a shape

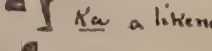

Ka a likeness, a figure, a shape


Ka, ever; Kas, boards


Ka, the earth


Kah, "


Kam, touch, handle, anoint


Kah, the forearm

K

Kah, an angle,

Kah kat, to extend the hands

Ka, an Egyptian mineral

Ka, " " "

Ka, to vomit

Kahu, a road, the way

Kaha, the margin of a papyrus

Kaa, to vomit

Kait, a title or function, mason or smith

Kati, " " " " "

Karu, a driver

Kah, a corner, or an angle

Ka, tall

Ka, to cry out, to lament, high-long, height, size

Kai, high, long, height, size

Ka, the Egyptian boomerang

Ka, a goat

Ka, steps, floor, height, elevation, a hill

Kaa, form, figure, condition, manner of being

Kaa, " " " " " " " "

Kaa; boards, to tie, to knot

Kaas, " " "

Kaau, a form, a shape

Ka, to reward, to recompense

Kaa, " "

Kaau " "

Kaa, height, elevation, a high building, a hill

Kaa, " " " " " " " " "

Kabu, to overwhelm;

Ka

Kabt, debility, infirmity, harm, ruin

Kabu, double, augment, reiterate

Kahu'k, reeds

Kahit, an angle

Ka, wicked, a miscreant

Kahaw, to break in, flog, subdue, to train, to exercise, to tame

Kahau w, horns, shalli placed as horns

Kaha, light

Kah ku, a painted chamber

Kai, a shape

Kai, to call

Kai, an elevated field

Kahak u, a Lybian people

Kairumala, horns, shalli placed as horns

Kaari with the article a camel

Kairu, a worker in metal

Kaka, agitated boast

Kaka, prey, booty

Kaka, a boat

Kaka, an oleaginous plant

Kakau, boat

Kaka, height, elevation, high building, a hill

Kamai, gum acacia

" " "

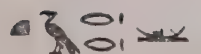
Kami, " "

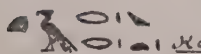
Kammu, dirt, dust, the soil

Kam, a boat

Kar, a worker in metal

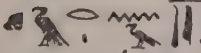
Ka, Kb

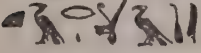
 Karuru, a boat for heavy lading

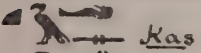
 Karuru t, earth, dust

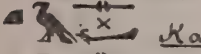
Karu neb hut, the name of a silver vase

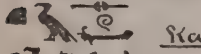
Kart, a lock

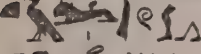
 Karunalā, phallus

 " "

 Kas, a funeral

 Kas, to embalm

 Kasu, to chain

 Karuan, a pilgrim

Kasan, the sides or bends of a vessel.

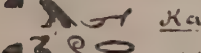
Kas, to vomit

Kalā, small stones, the smaller stone material used in building, finishing material, tiles, flags.

Kalā, a prickly bush

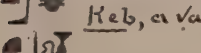
Kalā, peas, beans

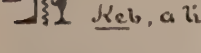
Kali, to rejoice

 Kat, a cell, a shrine

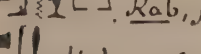
Kauirw, a boat of burthen

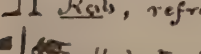
Kaui, night-time, obscurity

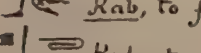
 Keb, a vase

 Keb, a libation, refreshing, cool, fresh

Kab, libation, honey

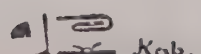
 Kab, place of libation

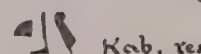
 Kab, refresh, enjoy

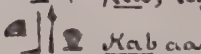
 Kab, to fold

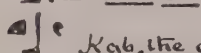
Kab, to fold, double, midst, augment, redouble, enrich, gratify,

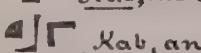
Kb, Kf

 Kab, corner, accords, turn, double, to give

 Kab, resplendent, brilliant

 Kab aa, honey

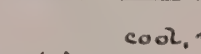
 Kab, the arm

 Kab, an angle, the corner

Kaba t, a horn

Kebeb, refresh

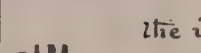
Kebeh; libation, vase for libations, cool, refreshing, moral laxity

 Keb, to mount, to rise

Kebeh, a libation

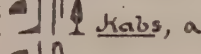
Kebeh, a libation, pure water

Kebeh, the pools of water left by the inundation

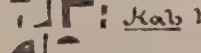
 Kebi, honeycomb

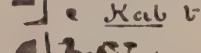
Kebi, a plant which ory's plied farinaceous food

Keb Kebit, cut to pieces

 Kabs, a palm tree

Kabs, to bind, fasten, secure

 Kabt, family

 Kabt, the arm

Kabu, palm blossoms

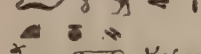
Kab, double

Kef, force, power

Kef rebel, rebellious

Kefa, force, power

Kefen, sacred bread

 Kefay, desolators

Kefni, sacred bread

Kefnu, zeal, ardor, bakebread

Kefet, to ravish, carry off, seize,

K

generally is used for such expressions as, exploiter of hearts.

Kefṭ, " " " " " "

Kefṭēn, the sacred name of the Cynocephalus

Kefṭēn " " " "

Kefṭēn, to squat

" " "

Kefen, to build,

Kefa, a lump of food

Kefa, " "

Kehehṭū, to herd goats

Kehek, old age, growold, old man

Keh Keh, to engrave

Keh Kehu, to chisel, to engrave, sculpture, cut stone

Kehṭ, a she goat;

Kehesher, fruit

Kahu, to touch, the shoulder

Kahu, the shoulder

Ki, touch, place

Ki, a division of land

Ki, a precious stone

Kiui, a perfume

Kirs, an incense

Kek, to strike

Kek, digest, eat

Kek, to taste

Kekhu, digest, eat

Kek, a boat

Kekek, rejoice

Kem, to create

" "

Km, Kn

Kemamu, to create

Kameh, a joint of meat

Kamṭū delight

Kemamu, to budge, to move

Kem, an ingredient of the Kyphi

Kemaṭi, ornaments, to ornament

Kemi, oils, perfumes, essences

Kem, gum acacia

" " "

Kem, a figure, a form

Kema, to create

Kema, a lock of hair

Kemamn, create, form, produce

" " " "

Ken, victory

Ken, to beat, overcome, force, victory

Ken, a strong place, a strong hold

Kew, numerous

Ken, service, power, courage, number

Kew, deficient, unhappy, miserable

Kew, a soldier

Kew, victory

Ken, binds, strands

Kena, a seat, a chair

Kena, a seat, a throne

Kena, to embrace

Kena, embraces,

Kenau, breast, bosom

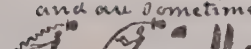
Ken, numerous, many

Kenau, labor, condition

Kenau, grease

Kenau, a place to retire to for repose

" " " " "

and are sometimes preceded by  ab Keni, a place of refreshment or rest, a cool place.

Kenau, the breast, to embrace

Kenau, the loins

Kenau, a sheaf

Kenau, a place of repose

Kenau, the breast

Kenau, a fig tree

Kenat, colors

Kenb, corner, angle

Kenbt, one who keeps in the corner, a courtier, chamberlain, dependant

Keneb, a corner, an angle;

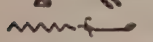
Kenebt, a courtier, a chamberlain

Kenebti a corner, an angle

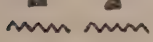
Kenebtau, an angle, to corner, to bring to bay

Kenef, a baker

Keni, grease

 Keni, victory

kankan, to convey

 Kenken, to beat, to maltreat to correct

Kenkennu, to leap

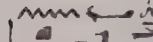
Kenken, to beat flax

Kenen, grease

Kenna, perfumes, liquors, rich, abundant

Kenent, grease

Kennu, power, victory

 Kennu, power, victory

Kennu, numerous, powers

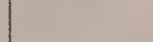
Kennu, powerful, rich, abundant

Kennu, a horse

Kennu, chastisement, flogging, a violent act

Kennu, an ingredient often mentioned in the process of embalming

Kennu, a seat, a throne

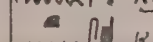
 Kennu, deficient

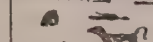
Kannu, numerous, abundant

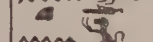
Kans, bowels

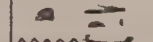
Kans, part of a bed

Kant, anger

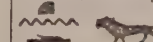
 " "

 " "

 Kent, valor, service, power

 Kant, fury, rage

Kent, servant, dependent

 Kent " "

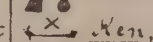
Kenti, numerous

Ken, unhappy, miserable

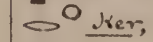
Ken, to burn grease

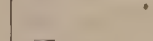
Ken, numerous, many

Kant, rage, fury

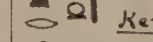
 Kep, to receive

Ker, a circle, round, pierce, drill, hole, cavern, zone, sphere

 Ker, " " " " "

 Ker, " " " " "

Kert, " " " " "

 Ker, calumniate

Kr

Ker, a bolt, lock, key

Kra, a storm, tempest

Kra " "

Kra " "

Krai, to vomit

Kras, to embalm

Kras, " Kras, subdue victorious violence disorder havoc

Kras, "

Kras, the place of embalmment

Kras, to embalm

Kra, to embalm

Kran, storm-, tempest

Krau, a jar

Kras, to vomit

Krau, a driver

Kra, a buckler

Krau t, a chariot driver, a conveyor of gold

Keref, to untie

Keref, food, a substance

Keref, to lie down, to be laid down

Kerfu, a veil displayed or spread out

Karh, night, night time

Karh, a jar

Karh, "

Karkar, to roll towards

Kerer, a holocaust

Kerer, a furnace

Kerer, a jar

Kerer t, a hole, a redoubt

Karmahu, a kind of tree

Karmahu, a kind of drink

Kerer, an orbit

Kr, Ks

Kras, to subdue, to be victorious, violence, disorder, havoc

Kras, to embalm, to bury, sepulture

" " " "

" " " "

" " " "

Kras t " " "

Kras " " "

Kras " " "

Kras t " " "

" " " "

Karti, the two cataracts of the Nile

Karti, the two rocks, near Elephantis, where the source of the Nile was supposed to be

Karti, holes, cataracts, passages, prisons

Karti, orbits, holes

Karti, orbits

Kasn, sorrow, misfortune, disaster, painful

Karut, the skull

Kes, to vomit; Kes, sheathing

Kes, bones

Kesu, bones

Kes, embalm, to bury, to swathe, bandage

Kes, to bury, to bandage or swathe

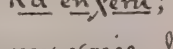
Kes t, " "

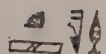
Ket, fire; Ku t, a farm

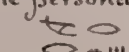
Ku, an oath, a pledge

Kuku, a cocoa-nut

Kayeru, to raise the voice; cf

seems also to have expressed the idea of a cry, an imprecation, the utterance of a magical formula; nen ari a Ka enxenu; I have not raised my voice, I have not cursed or used magic; a variant is 

 Kesh, a reed; a plant or tree of the calamus kind

Ka, the being, the personal essence, the individual;  merit u

Ka ef, beloved by him; a bull

Ka, a bull, a male, a husband, the fecundator

Ka " " " " " " "

Ka " " " " " " "

Ka u, offerings

Ka, the being, the personal essence, the individual

Han Ka, a priest, a minister or a

Han Ka, " " body servant

Ka, a box

Kaka, dry grass, stubble

Kam, a precious stone, hematite

Kamu, a cellar, a storehouse, the palace where the grape crop was stored, the store of wine

Kami t, the same as Kama and by extension a vinegrower

Kat, wise, wisdom

Katu, work, workman

" " "

Kauti, build, work

Kau u, essences (divine)

Kab, a measure

Kabu, "

Ka ef, by him, his essence

Kaheb hut, an aromatic plant

Kahek, the month of Choiak

Ka han, a vase

Kai, a title

Kaek, thyself, (for thyself)

Ki, a skilfull, a prudent man

Kak, a goat

Kan, a melon

Kar, a gardener

Kar, a shrine, a chapel

Kar, a gardener

Kar, a chest, a sarcophagus

Kra, a chapel, a shrine, a sarcophagus, a sanctuary

Kraa, a widow

Kra t, a chest

Kra t, a sarcophagus

Karu, a fisherman's boat

Kari, a gardener

Karama, a vine

Kari, a carrier, a bearer

Karui, a boat

Kerer, a jar for milk, honey re

Karu karu, a royal ensign, a roll a cylinder

Karuta, a lock of hair

Karu, a boat

Kat, work, labor

Kt, Ku, Ka

Kat, work, workman

" " "

Kati " "

" " "

Kat " "

Kaiu, craftly, cunning

Kalāmer, a mineral, a stone

Kalama a mineral; a mythologi-

cal ape's eye was formed of this stone

Katen, a groom, footman, runner

" " " "

Kalēna, a groom, a foot-

man, a runner, a squire, a

general of cavalry

Kalālu, a kind of woven stuff

Kauti, work, labor

" " "

Kaua t " "

Ka, a seat, a throne

Ka, the lower part, the tail

Ka, nails, studs, or some metal

Ka, to rest, to repose

Kaf, ape, monkey; Kab, cry

Ka, life, person, excellence, essence; is

a variant of

Ka, a liquid

Ka, foul, pestilential

Ka, to see, look, spy

Ka, a bull

Ka, to evacuate

Ka, a talisman worn

round the neck

Ka, to place obstacles

Ka

 Ka, beyond, overmore, true, to re-

tard, to prevent

 Ka, to sing; when followed by

 em sa, to play upon an

instrument

 Ka, some part of the face

 Ka, foul, destructive

 Ka, to deprive, to carry away,

to empty, without, indigent

Ka, foul

 Ka, a post

 Kaau, to defile

 Kab, weak, miserable, feeble

Kab, melancholy, unfortunate

Kabu, to call, to invoke

Kabu, to crush, to massacre

 Kabuenur, misfortune, melan-

choly

 Kab, tears, to cry

 Kab, the arms

 Kab, the arms

 Kabu, to break, tire, fatigue

 Kabui, melancholy, unfortu-

nate

 Kabu, to oppress

 Kafi, an ape

 Kafi to bake bread

 Kahu, fatigue

 Kahs, a gazelle

 Kai, the desert

 Kai, foul, sore

 Kai, a jar

 Kai, naked

 Kait, desert

 Kai, amaranthus

Ka

hai, amaranthus oil

haiu, amaranthus

haiui t, a coffin

Kaka, to chatter

Kamai, a plant from which was extracted a precious oil

Kami t, a chicken

Kau, a monkey

Kannush, fruit, figs &c

or Kanew, faint paralysed

hanen, an ingredient of the Kyphi

Karu, incense

Karuta, the skull

Karuta, a stalk, or flowers

Karutana, a pitchfork or an agricultural implement

Kas, a carpet, a thick cloth

Kas, to water, to sprinkle, to moisten, to rub, to anoint

Kasa, to shave the head in token of mourning

Kat, a throne; , a mason

Kat, a paw, a claw

Kati, a road; Kat a paw a claw

Kata, an Asiatic ointment

Kaua, a bull, a stallion

Kauasha, to displace, deviate, tear away, disorder, crime, violence

Kauatanmu, to

Ka, KK

mend, to repair

Kau, to lighten, to compress

Kau t, to pull down, to throw down to demolish

Kash, to water, to spread, to inundate, to sprinkle, to spill, to pour out

Kash, to cry for quarter

Kash, a reed

Kab, to bend low, incline, unfortunate

KabKab, to cut down

KabKi, an animal of some kind

Kabti, the arms

Kabti, the hair, a lock of hair

Kabtiuu, arms

Kab, the vault of heaven

Kab, to bend, to prostrate—

KabKab, to cut down

Kef, a monkey

Kef t, a female monkey

Kefu, an ape or monkey

Kah, to drop the arms

Kahs, a goat or gazelle

Kahs, " "

Kahs, " "

Kahs, " "

Kah, a seat; Kehab strike crush

Kahs, a goat or gazelle

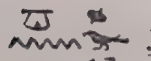
Kamti, sighs, groans

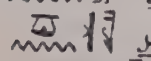
Kamesh, hair or headdress

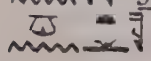
Kana, memorandum, recollection

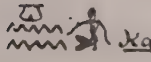
Kaneb, a lock of hair

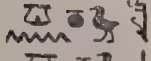
Kn, K-

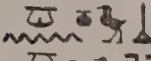

Kan, malice, pride, vanity &c.

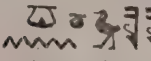

Kan, a title, a cartouche

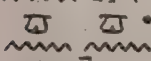

Ken t, a memorandum, a recollection

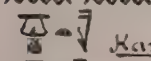

Kanen, weak, feeble, faint, infirm, paralysed.

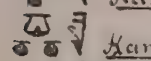

Kennu, titles, inscriptions

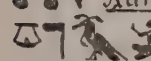

Kennu, stands, hemp


Kennu, titles inscriptions

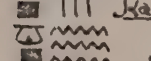

Ken Ken, the name of a medicine

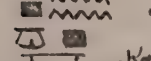

Kan t, a plant, (a reed)

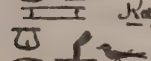
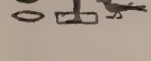

Kanen, "


Kaneter, a mason

Kap, a storm

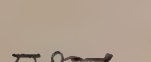

" "


Kasp, an inundation

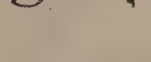

Kar, falsehood, lie, deceive, craftily;  Kar xeti per, the things of the house were stolen; fraud

Kar, entrap, seize, contain, fraud

Kar, scent, ravish, trample, hasten, harness, to take one to, garrison


Karch, to receive almost, to go on a duty, to be charged with - to finish, quiet, ease, to direct

Karni, opium sylvestris, cardamum sylvestris, cress


Kara, a box

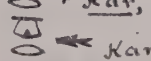
Kara, a mason

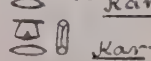
Karan t, steersman, driver

Kar, carry, business, under at

Kr

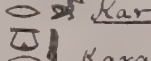
Kar, the lower part, the tail

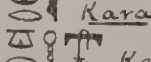

Kar, the tail

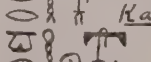

Kar, food sustenance

Kar, a drop of rain, a storm

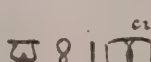
Kar, silence


Kara, "


Kark night


" "

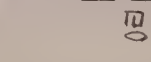
Kark, a pause in writing announcing the passing to a new subject


Kar heb, a priest, stolophorus

" " " "

Kar hu, night

Kar hru, in the course of the day; heri hru, the beginning of the day.


Kar her4 in the course of the day

Kar heb, a priest of superior rank, a lecturer at panegyries

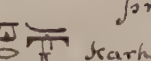
Kar heb, a minister, a choachyte priest

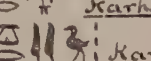
Kark, night

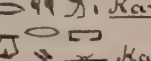
Karu n4 with them

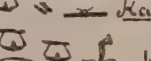
Kari, a house

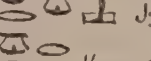
Karka, to prepare

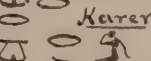

Karer, to jabber, to cackle

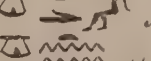

Kart, a boy


Kar t, a cataract


Kar t, the course of the day


Kar t, to bear, to carry


Kar t hru, course of the day


Kar t, silence, fraud

Karlu, testicles

Karu, to take one-

Karuu, testicles

Karu u, objects, matter

Kar Xeben, the unjust

Kas, to cut

Kat, like

Kat, consider

Kat a fishpond

" "

Kat, a shrine

Kat, a chapel

Kat, a seat, a throne

Kat, a throne

" "

Kat, a title, an inscription

Kat, a dry measure

Kat, an Asiatic ointment

Kat, a fishpond

Ku, a goat

Ku, one of the branches of the Nile

Kui, a coffin

Ku t, rogues, a vile race

Kuuat, a title

Kuuat "

Kua, to lighten, to compress

" " "

Kua, to lay siege to a city; head

Kesha, sharp, trenchant

Kem, a space of time

Kam, black, solid, well done

Kem, black

Kem, a space of time

Kem, to become black or dark

Kem, a valuable wood, ebony?

Ka, a bull

Kam t, a nutritious plant

Kami t, Egypt

Kam, black; anru Kami, (oil of) black stone, probably bitumen?

Kem Kem, to perish, ruin, decrease, wither,

Kamit t, lamentations, lamenters, cry

Kemt, " " " "

Kemti, a figure, a form

Kamut; to place to carve

Ket, a bone or a nail; sahi, the bones of the leg

Ket, a resin for purification

Kesemtiu, artists, decorators of funereal coffers

Kesn, misfortune, misery, disaster, painful, sorrow

Kenu, artists, decorators of funereal coffers

Ken t, time, epoch; sah, to assemble to meet to approach

Kenn, the carving of ivory

Ken u, titles; sah, to be gratified

Ken, deficient

Kennu, titles

Katu, workmen

Kanit, a cow

Kepu, to hide, conceal

Kepu, to fumigate

Kepu t, to hide, conceal, to hurt

Kepu, yeast, ferment

Ker, wheat

Kar, adverse, evil, contend

K.

Kars, a battle, a melee, (the

Det. arm is ideographic only)

Karau nakt, of valor, bat-

tle re

Kens, an Ethiopian bow

Kens, to delve, to found

Kettu, a cauldron

Keti u "

Kes Kes, to dance

Ken a fat ox.

Kefs. sole of the foot

Kefs, to hide

Kefs, a name of Typhon

Kefs, to warm, to light

Kefs, food offering

Kefsu, " "

Kefni, 'perfume of Kefni'

Ka, the bull Mnevis

Kaen nak, 'Bull of might-'

victory, power, valiant, over-

come, subdue.

Kat, a knife

Kat, a laborer: Katí, forms, types

Kam Kam, a sword

holy places

Kat, to sleep

Kat, an odoriferous wood

Kat, to direct to steer a boat

Kat, when preceded by ma, like,

the same as, the condition it is

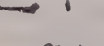
in, in its entirety

Katbit, to apportion

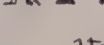
Kalem, ?

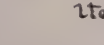
Ket.

 Kati, to circulate, to travel

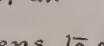
 Kalēnu, qualities:

ma Kalēnu, as well, likewise

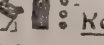
 Kalēnu, business

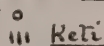
 Kalēnu, to build, to form

Kalēnu, perfidious, craftly

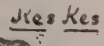
 Kalēnu, to shape on the wheel,

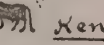
to form, to create

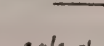
 Kalēn, to build, to form

 Kalēmu to move about, to circu-

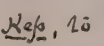
late

 Kalēmi, to sleep

 Kalēnu, a sculptor

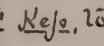
 Kalēt, to shape on the wheel,

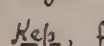
to form, to create

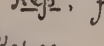
 Kalēt, to move about, to circulate

Kalēnu, to form, to build

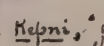
" " "

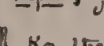
 Kalēn, image, likeness

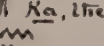
 Kalēnu " "

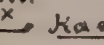
 Kalēnu, to form on the wheel, to

form, to create

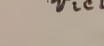
 Kalēnu, perfidious, craftly

 Kalēnu t, to form to build

 Kalēmu, to sleep

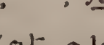
 Kat, a circle

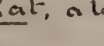
Kat a drachm, 9 grammes

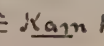
 Kat, a workman, an artisan

Kati, a laborer, a satellite

Katiu " "

 Katiu, a workman, an artisan

 Kalu, an evil doer

 Kaluu, bondmen

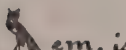
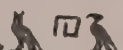
Kaiu mensh, boat labo-
rers, boatmen, mariners

aat, type, image, likeness

" " " "

aaiu, to cry out, to invoke

M

 em, is sometimes a negative, as 
em hai, do not fall: It is
also interrogative, prohibitive &
privitive; with, from, by, as, no,
not, like

ma, to give

mauhu, a paddle, an oar

mah, a paddle, an oar

ma, with, by, from, in, of, may, to
take place, to cause

ma her, to give face, to pay attention

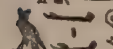
ma, to come

ma, " "

maa, a son

ma ai, may come

?

 em liliui, in the power of, in hands of

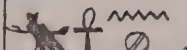
maaa, a kind of salt used
in embalming

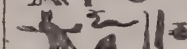
maaam, salt

maaa, probably a stone or a
pebble

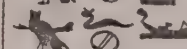
maan, dead fish

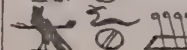
maa, to squeeze, to compress;
a torture, compressing the hands
and feet

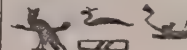
 maany a counterpoise

 majeklā, a vase, a bottle

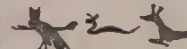
majex, to land, disembark

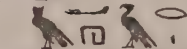
 " " "

 majex, the prop or supports of
the sacred barges.

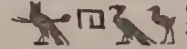
 majesh, to land, to discharge
from a vessel

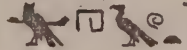
majek, turquoise, pleasant, en-
chant

 maj, a lynx

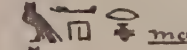
 mahaw, title of a funeliomary

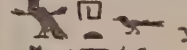
mahati, fire

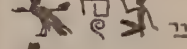
 mahau, people, tribe, family,
relations

 mahaur, " " " " "

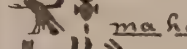
mahen, a liquid measure

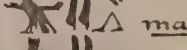
 mahex, " "

 mahr, deceit

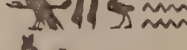
 mahu, family, connection

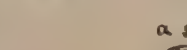
maher, to give the face to-, to give coun-
tenance to-

 ma hati, to give heart, to cheer

 maii, may, come!

maii ?

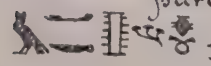
 maiu, the sea

mak, to be; at the beginning of
a sentence was used instead of
 ; since, because, protect

mak, food

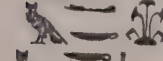
mak, man

mak, to protect as with a rampart

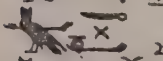

mak anbu, protected by a wall, encircled by a wall

maka, certes, verily

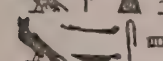
mak, think, consider


makha, the back of the head

maki, precaution

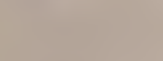

mak, think, consider, take care of

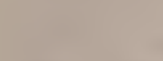
maks, ?


makes, the sceptre 'Makes'

maklarw, the wall of enclosure, the battlements of a fortified place, a tower, a fortress, a town, Migdol.

maklaru, ...

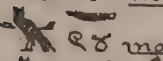

maku, care

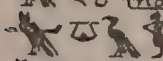

maku, linen, flax

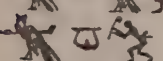
maka, a veteran

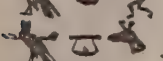
maka evil

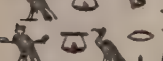
maka "


makarutu, a dew


mama, impure, uncircumcised, an impure man

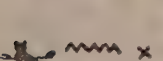

mani, the bastinado, beating


manilekla, a bottle


manen, to bind, to twist a rope around, to frap.

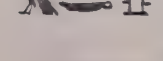
mannui, the two serpents

mar, to oppress

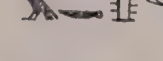

mar, a palace in the temple where the divine statues were to be seen whom offerings were made to them

mar, mat

mar, dress, garment, robes


maruna, chief, lord, superior

maruna, chief of asiatic auxillaries


maruh, a club or mace, a confusing weapon

mart, misery

mas, to bring tribute

mas, to bring, to introduce

masi, " " " "

mas, " " " " "

malu, to cut with a sword

malu, hard,

amru mat, a hard stone, granite

matet, open, unwind, unfold

matet, " " " " " "

mata, to strike, to push, to thrust

mates, to squeeze, press, to strike, to open a road, to open something closed

mat, to tie, to attach, to envelope

matennu, cutting instruments, blades, swords, Knives

matani, truly, certainly, certes

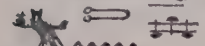
matennu, a road

matemi, the principle of evil symbolised by the hippopotamus

mats, hard, rough, to kill

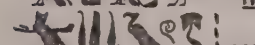
mat, max

mat, a road, a path;

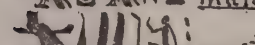

matēn, a road

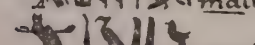
when preceded by ○, er matēru t, who, what

matabu, the poop of a vessel

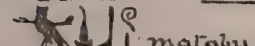

matatau, leather thongs

matait, a mummy swathing


mati., foreign hunters

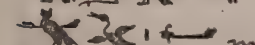

matāiu, a police, composed of foreigners, having the surveillance of the monuments in the necropolis

matab t, a hatch, or hatch cover


matabu, " " "

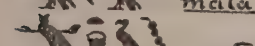
mata, a phallus

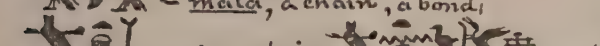
" "


matā, a title

ma tū, many

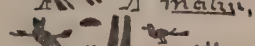
matā, the spine

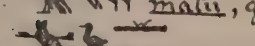

mata, a chain, a bond;


mat, a chain; road

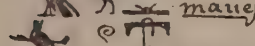
matai t, a girdle

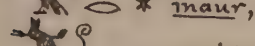
matiu, 'as for you'

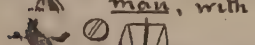

matii, grief, bitterness


mau, a servant, domestic

mauef, " "


maur, midnight


mau, with


maxi, to adjust, to balance

maxila, the ornaments of a chariot

maxer, to take care of- to pay attention to-

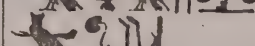
mat, mash

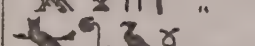
maxa, to balance, a balance, adjust

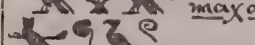
maxa, " " "

" " " "

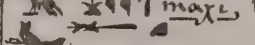
" " "

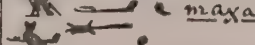

" " " " "


maxa, to strangle

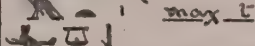

maxu, despoil, strangle, kidnap

maxi, to balance, to adjust

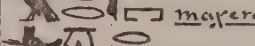

maxak, the throat


maxaK, " "

max t, the intestines


maxer, to take care of- to pay attention to

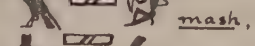
maxera t, magazine, wheat store

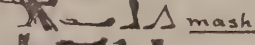

maxer t, " " "

maxeru, tribute

mashru, evening

mash, a soldier;


mashu, to walk

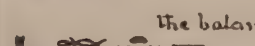

mashu, a dagger

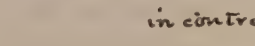
mashent, a travelling barge

masht, battle, slaughter

mashen, travelling barge

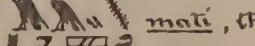
masharuru, a part of the balance

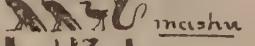

mashet, a navigable canal, in contradistinction to an irrigating canal


maa, come

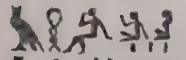
mati, the neck

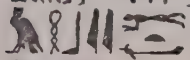
mashu ?

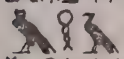

mabaa, extraordinary, exceptionally

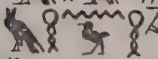

maska, copper, turquoise, pleasant

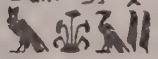
mh, mm

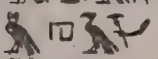

meh, the weak

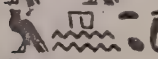

mehbi, humble

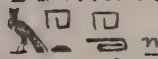

meha, a crown

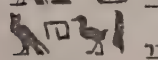

mehenuh, shake, quiver

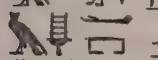

mahai her, besides

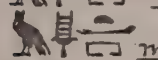

maha, leave

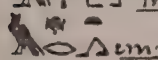

Mehennut, the great serpent

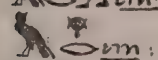

mehah t, enclosure


mehua, family


meha, a sepulchre


meha t, "


emsher, with the exception of-


em sher, beyond

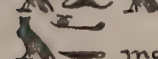
miu, the sea

mimi, a kind of date, or it maybe, the cocoanut

mak

mak, to dance

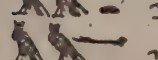
em Kefau, on the contrary


mak, give, make, over, plate

mak, to adulterate

mem, warm

mem, a flute


mema, with, by

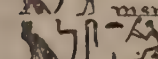
mema ut, many

mem, with, during, among, amid

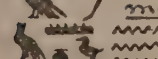
memau, a beast

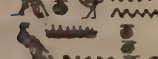
memti, the cabin or the forecastle of a vessel

memu, hatred

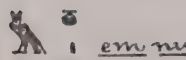

memas t, hatred

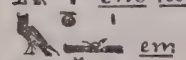
memt, also


memnu, palaces, pools

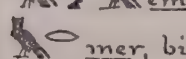

memnu, gifts, memorials

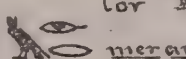
mer

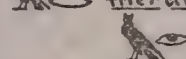

em nu, well, in good condition

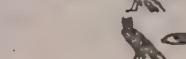

em nu, well, also

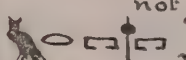
em nehem, again


mer, bind, superintendent, governor, King's official, overseer, director meru, id.

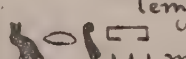

mer ari, to bind


em ari ha, do not stop


em ari sura, do not joke

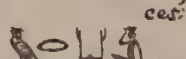

mer per huti, superintendent of the treasury

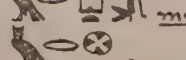
mer neter hanu, the chief of the prophets, the superior priest of a temple


mer ma peru, governor of temples, archpriest

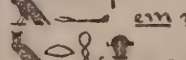
mer ab t, the superintendent of the workers in wood and copper

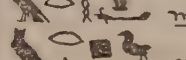
mer per u en sutenmessu, the superintendent of the young princes' abodes.

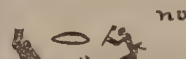

merket, chief architect

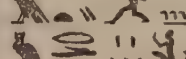

mer nut, superintendent of a temple or governor of a city

em ra, thus, verily, of a truth, truly


merh, wax, to anoint


em rusu, on the contrary, nor, not more than, neither, or

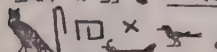

merti, the dead

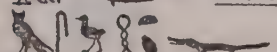

mer tut, superintendents of five

emseh, a crocodile

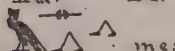
mś, mt

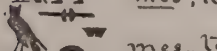
emsehu t, a crocodile


emseh, to mislay

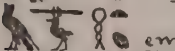

emsuh, a crocodile

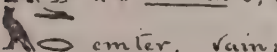
meslēm, collyrium


mes, to bring, to introduce, bring (to)

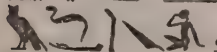

mes, to bring, a cake, or some food

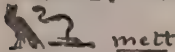
meslu, a kind of food, a cake

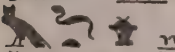

emsuh t, a crocodile

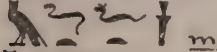

em lēr, rain; mat, chain, bond

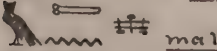
malō, hard thick

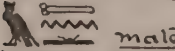

emlā, reverence, fear

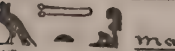

mett, to die

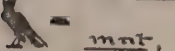

met t, oil


metref t, a sword


malēnnu, a road, a path


malēn, the means, the way


mat t, mother

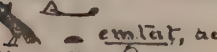

mnt, to die

" "

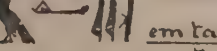
a monarch

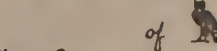
mut, death

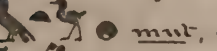
emlilēn, you, ye

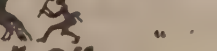

emlāt, according to, on the part of, inasmuch

malauh, a chain, a bond

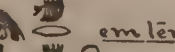

em tatí, do not give; an exclamation of negative

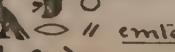

mut, death; emtū, being

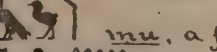

" "


" "

em lēr, at all, when


emlēri, awhile


mu, a foreigner


mu, germ, descent, obedience; enti hor nu ef, who obey him

mx, msh, ma

emaxt, whilst, when, (after)

em naxt, whilst, when

maxt, a mason, an explorer of mines

maxalū, reservoirs, basins

masha, an archer

masha, a captain of infantry

masha, soldiers, infantry

masharu, incense of an inferior kind

masha hatí, incense from the country of Am

max, a balance

masha nefenu, recruits, young

maker, a mortar

mat, to die, death

ma, like, so, and

ma, like, according to, as, copy. s'ma, the will; lū ma ax, how art thou?

ma, a cat

" "

" "

ma, a road

ma nen, of the same rank

man, a cat

ma nen, of the same rank

mana, a fellow, an associate, a familiarity, a community of interest, equality, the act of

ma, mr

living together in common

mi, woven stuff, fine linen

mi, a cat

ma ax., which is it? how is it?

lu ma ax., how are you

ma lu, as said, as if said, suppose,

ma lu en ek, like as if it had been told you- suppose, as if it were, so to say

mat, a road

mau, a cat

" "

" "

mabt, a carpenter's axe

men, daily, perpetually

mert, a female office or relationship

mast, kidney

em nennu, as, as well as, like as, thus, so-

mah, equally, alike

mati, copy, reproduction, truly

mati, alike, truly

maui, brightness, beauty

ma, in, with, from, by, as

" " " " " "

ma, a recluse, a woman of the harem

ma per, harem

mui, light

mui "

mauiti, likewise

ma, give, gift

mennu gifts

m

mat, mother

mafek, turquoise, pleasant, rejoice

mafek " " "

" " " "

mak, duration

mak, to rejoice

" " "

mak, to cover, to protect, to preserve, to envelope

mai t, the tomb

malni, a precious tribute brought by the Rotennu

ma t, fruit: oil offering

ma t, a place

'ma, in, with, from, by, side of, how is it, for, of, like; em ra, to make; em setu, from the soil; em ra kat, in construction; while, a half

'ma, come; ma, a place, a temple

ma per u, temples

" " "

em as, in the place of, in regard to, according to

mah, an oar, a paddle

mah, a chain

ma hes, a headache

ma, a place, to give, to concede

ma, truth, exhibit

m:aa, come, approach

maau, the hair

mafek, copper,

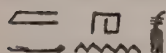
mahau t, to do homage, to obey

mahau, youth, soldier, hero

" " " "

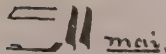
mahi, a relation

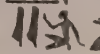
mahaauti, family, relations tribe

 mahen, a liquid measure

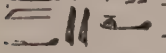
maha, a kind of measure for homegranites

mahau, to despoil, to undress, to strip

 mai, the optative form, may, let;

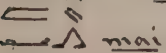
 mai ak, let me or may I enter

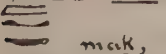
maii, to utter shouts of joy

 mai, to give, to make, to do

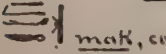
mai u, seed, germ

mai, urine

 mai, come

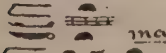
 mak, regulate, so that

mak, a boat for grain transport

 mak, consider, take into consideration, reflect on, examine, since, because,

maka, certainly, truly

makasta, a grove

 mak t, fields

makha, to put behind oneself. to reject, to turn one's back on; The contrary sense, is, to stand behind one, to protect, as Isis protects Osiris standing behind him with her wings outspread

maklaru, a tower

mak, the crocodile symbolical of the evil.

maka, a fighter

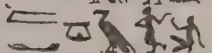
maka, fire, smoke

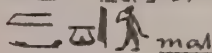
maku, arrow, dart, archer

maka t, ? (slaughter house)

maka, courier, groom, adult

" " " "

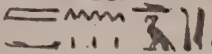
 maka, a veteran

 maka, a courier, a groom, an adult

maka t, ?

makahau, the back of the head

maka aa ru, fire smoke

 manulala, jewels

mamilila, besides

maruh, alone

mapu, a title of honor

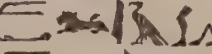
maruna, a groom

maruruaa t, whip, killer

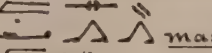
marui, part of a door

makaruta, a cavern

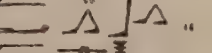
makaliru, an enclosing wall, a tower

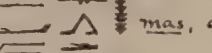
 maniaa, a groom, a driver

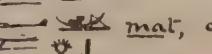
maniau, " "

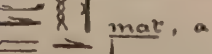
 mas to bring tribute, or present to us

" " an act of homage

 " "

 mas, a bouquet of flowers

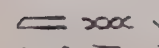
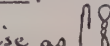
 mat, cabin

 mat, a voyage

mat, cabin, the going into a cabin

" " " " "

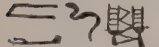
mai

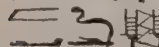

mat, the solar barge, of sunrise as  sekhti was that of sunset

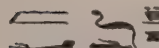
malau, to tie securely, to be attached to, to envelope

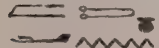
malaba, a finger

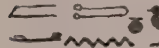
malen, resting, in peace, welfare, quiet

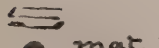

mat, to open, by force, something


" " that is closed, to open roads, to press, to squeeze


malet, a whip


malennu, to facilitate

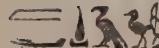

malennu, to facilitate, to give way to,


mat, the truth, truly, to do right

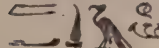
malennu, road, path

" " "

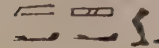
malen, cutting or edged instruments, such as knives, swords, blades etc

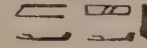

malau, mercenaries, the police of the necropolis

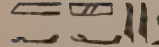
mala, cultivated fields


malau, " "

malau, the hunt, hunters


maska, to walk, to march;


mashai t em sa, to follow


mashai, " " " " "

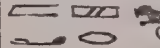
masharu, an inferior kind of incense

mashai, part of a chariot or

ma, mr

its harness, traces or straps

mashepu, the barge of the dead

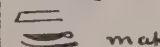

masherru, the evening

mashennu, barge of the dead

" " " "

ma, with

mai t, some substance

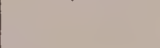

mau, dead fish

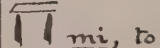
mak, the tongue

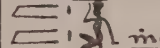
maks, the whip, flagellum

mahauti u, a courtier's family

mahu, an officers' family


mai, a clasp, the eye of a hook + eye

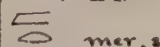

mi, to wade


mama, to bear

memen t, daily, perpetually

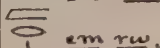
menen t, corn

em ma t, also


mer, superintendent, overseer, governor

" " " "

mer, to die


em ru, at the opening, at the entrance, at the mouth - em ru abt, at the eastern entrance

meruu, death

emsuh, a crocodile

mekerru, an animals hind quarters

" " " "

masau, to extend oneself on; to anoint, to rub, a lotion

masmu, the current

mas, hale

ms, mt

mas, to anoint

masi, to bring

masmas, to dis

masi, to bring a tribute present

" " " "

mas, to walk, to go ahead

em sa, follow, following, à la suite

masmasi, to aggrandise, to enrich,

to furnish abundantly

masmas, partition, to divide

to measure, to portion

masmas, " " " " " "

masef2, provisions, food

masrn, something used in connection

with lamps or fire

mals, a hard stone, a whetstone

malauh, a chain, a bond

masu, to extend oneself on, to a-

noint, to rub, a lotion

mest, a palette

meslā, "

met, die

met dead

met, ?

met, ?

mau, a kind of food

muhut u, nomadic tribes

em tūtū, a kind of indefinite pronoun

" " " ", em tūtū ari,

let it be done

maxi, above, after

max, when, whilst

max, ma

maxa, desolate, desert

maxt, after

max, while, when, after

maxt, " " "

max, a balance

masher, the evening

ma, the Truth

ma, a sacred ornament

ma, true, real

mau u, the just, the good, the true

ma, wind, vapor, cloud, a puff of wind

maxeru, called the just, said to be just,

justified, the justifier,

ma, to go, to walk

maxeru, the justified

ma, to destroy, n° nine, 9

ma, dead, cut

ma, see

" "

" "

ma, a beast

ma, a place

ma, to slay, to cut, to immolate

ma, to cut

ma, true, truth

ma " "

ma, a puff of air

mennu, gifts

ma, to come

ma, true truth

ma, some substance

mia, to make an offering, to present

mia, to open, to extend, to extend the arms

ma

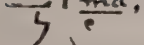
ma t, wind

ma t, air, cloud, wind

ma, sacrifice, offering, fresh, offering

ma, imperative form, come!; ma heri en ek, come if you please!

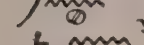
ma, fresh, recent

 ma, the shoulder, the side

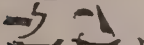
ma, true, truth; or hebs ma, in reality, clothed in truth

mahu, wonder

maney, counterpoise of a collar

 mani, the bastōnnade

mat, to offer a victim

 manu, bolts or bars with which doors were secured

maxeru, truth giving, justifying, assuming a function of Ra (the Sun) the Truth; Words partook of the character of Ra when they were uttered by Pharoah; The dead became verified or justified, in the hall of judgement, by Osiris

" " " " " " " "

mahes, a lion

ma, to shine, brilliant, splendor

ma, new; smai, to renew: em mani, anew

maa, to see, to look, to recall to oneself.

ma, to grow, to live

ma, to see

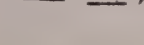
ma, to give, to grasp

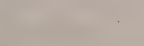
ma

 ma, a beast

 ma, a stalk

 em ast ret, the ancle or the sole of the foot

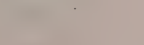
 maar, powerful, puissant

 maaru, poor, miserable, unfortunate

 maau, a lion;

 " "

maa, to see

 armaa "

armaa "

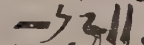
 armaa "

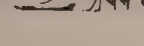
 maa, the sole of the foot

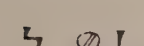
 mai t, a chapel

 maui, among, a pick re, re

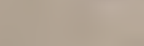
 mau, a paw, a leg, an arm

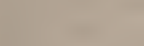
 maanuru, a fort

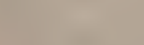
 mati, a seat

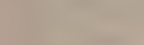
 mat, a seat; a chair, a dais

 mau, a stalk

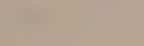
 mau, a bench

 mau, light

 mau, a stalk

 mast, light

mast, alynx

 " "

" "

mah, a wreath, a crown

 mahun, sides of a ship, waterline

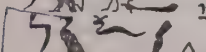
 mahu, a chaplet, a crown

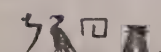
 mahu, " "

 mah, a kind of antelope

ma

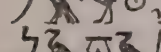
mahu, a cornice

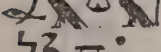
 mast, to traverse, to travel over, to wander

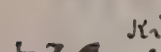
 mah t, the door of a pylon

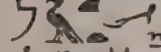
mai t, a lance or spear

maiu, light, beams

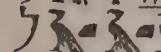
 makasu, a dagger

 mak, a kind of stone used in making amulets

 mak t ?

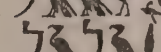
 maka, a mast

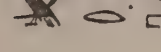
makaku, moisture of the earth

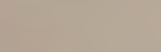
 mamu, to run, a courier, a runner

mamu, to kill, to massacre

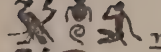
mama, a doum palm

 maen nu, the open, unroofed space in an edifice; the court the vestibule

 manu, to attend to one

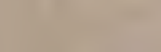
 mar, to grieve

maruau, a groom

 maru, the open, unroofed space in an edifice, the court, the vestibule

mas, a calf

mat, middle, the heart

 ma ula, a gazelle

ma t, an island; mat, fresh, new

mat, a lion

ma t, a east

ma t, hard, granite

mat, grow, renew, die

mat, new, fresh

ma

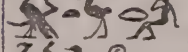
mati, ancles, feet

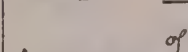
" " "

mati, a runner

matiu.u, police of the tombs

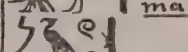
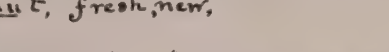
matur growth, renewal

 maau, a bouquet, a tuft, a tuft of tamarisk

 mau, a mirror

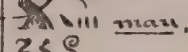
mau t, fresh, new,

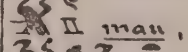
" " "

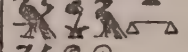
 maui, " "  merh maut, fresh oil

mau, an island

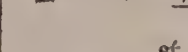
mau, a place, water

 maa, the beam of a balance

 maui, light

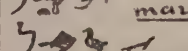
 mas, the name of a certain space of water

em aut, a stalk

 maut, a chair, a dais

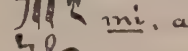
maut, a chair

mahu, a wreath

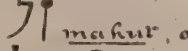
 mi, a wild beast

mah t, wonder

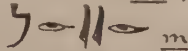
mahut, a gazelle

 ma, a wild beast

mai, to see

 ma, a mirror

maui, shine, brilliant, splendor

 mi, a wild beast

mi, an island

mah t, the door of a pylon

mem, a courier, a runner, to run

mt

mem, a doum palm

mema, a kind of tree, to mow

mem en penen t, a cocoanut tree

mer t, a cistern

meruit, evidence

mes, a calf

" "

metiu, an overseer

mat, granite

mat, a witness

mets, to walk, to mount

meti, a scorpion

mat, Syenitic granite

mat, " "

ast mat, the sole of the foot, also an instrument in the shape of a thigh or hindquarter, with which the mummy's mouth was opened, (in Amenti) an operation called the aps ru, Open the mouth

mati, crocus hortensis

mati, crocus terrestris

mati, crocus palestris

mu, death

mu, new, anew; set em mu, restore them

mes, inflamed, flaming, brilliant shine

may, devoted to, an ordinal prefix

meh, a belt, a girdle, an ordained sacrifice

meh, a cubit, a fore arm's length,

meh

meh, to be full, covered, ornamented, to fulfill, to be master of a thing, to possess, to take, to seize, to coincide, complete, power, domination, control, to be occupied in - to do an act needing power, skill

mehu, " " " " " " " "

meh, to fill, to cover with water, to submerge, to inundate,

meh, " " " " "

mehi, " " " " "

in late date was used for ; satisfaction

meh, a feather, a wing

meh hati, satisfied

meh, abyss

meh, to arrest

meh, a crown, a chaplet

meh, the North wind,

mehi, a crown

mehi, a kind of fish

mehi, the North wind

or meh, the North

mehi, " "

meh, a crown, a diadem

mehi, the North, Lower Egypt

meh, a stone of which amulets were made.

mah, flax, linen

meh, care

mehen t, the Serpent Mehen

meh t, a liquid

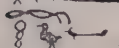
meh t, a vase for ointment, or stibium

meh t, a crown (of L.E.)

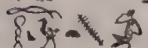
meh

meh t, a fan

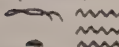
mehi, to drown

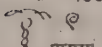

mehu, to launch, to rig or to hire a boat

mehu, North

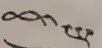

mehu t, to fill

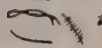
meh " "


meh t, to wash gold

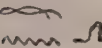

mehu, a stone of which amulets were made

" " " " " " " " "


mehu, a wreath; mehi, illuminate


mehin, a gazelle

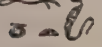
mehen, The serpent Mehen


" " " " "

mehen, a crown

mehemi, the two Mythologic serpents

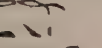
mehen t, the serpent Mehen

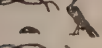

mehen t, a crown

mehen, the residence of Osiris

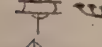
mi, a fish

meht, the north; mehti N. wind


" " "; " " "

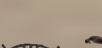

" " "

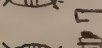
mehti " "

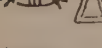

meh, wood, grain

nefun, a sailor.

nefun, a breath, an inspiration, a whisper; 'I give inspirations in my quality as general in the army'


mesen, a sanctuary at Edfoo

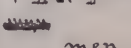

" " " " "

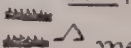

mesen, a chamber at Edfoo, where the Gods were roved

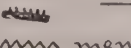
men

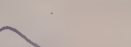
meru, the bull Mnevis

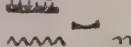
mer, to suffer physically or morally


men, a chequer-board

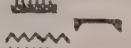

mem, firm

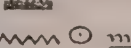

men, a territory, a district, to place, firm, on, a station; to establish, men tā,


men, a mountain

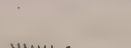

men, " "

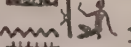
men, heaven

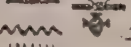

men, daily, constantly, perpetually


men, no, not, that which should not be.

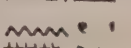
men, firm, well founded, well based, well established

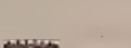

men, 'such an one', tel ou tel

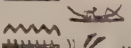

men hati, firm hearted, resolute

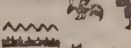

men, the fore arm

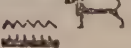
" " " "


men, leg, shank, thigh, the upper part of the leg

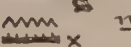

men, a boat

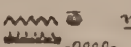

men, place of repose, sejourlere, bier

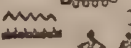

" " " " "


men, no, not, defect.

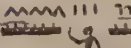
men, a fault

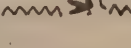

men, a jar


men, a liquid measure

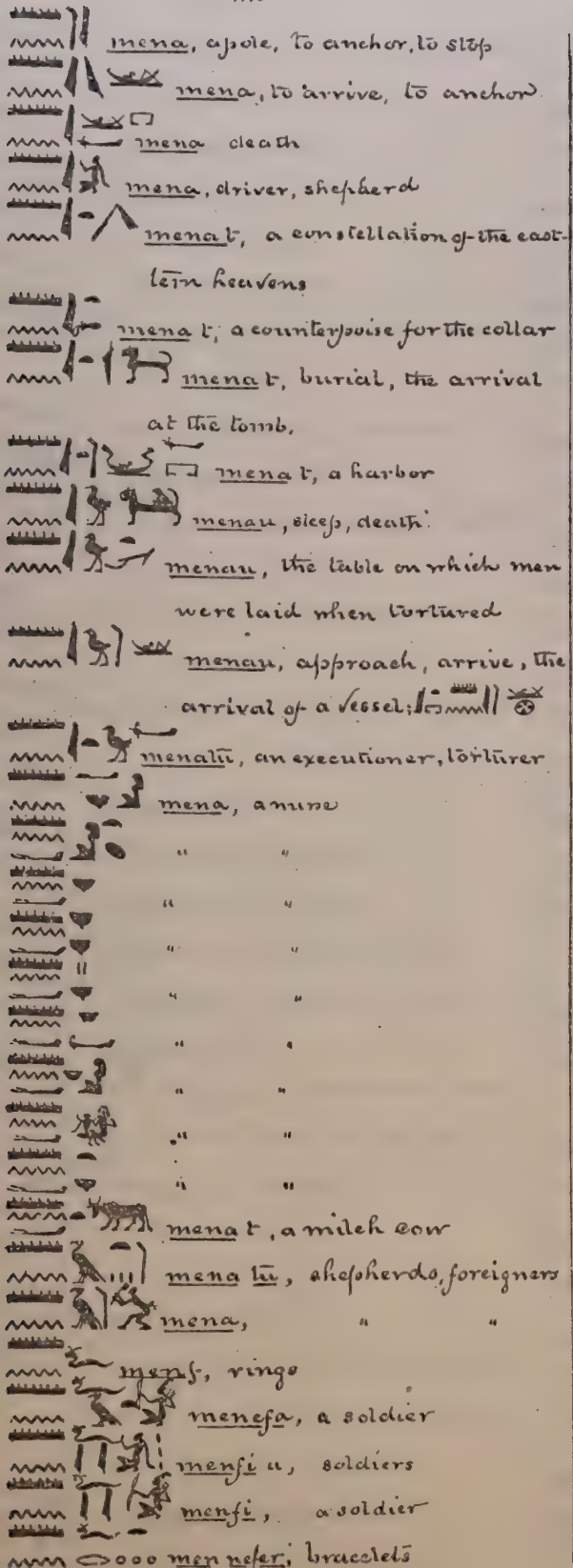

men, hide, conceal, a variant of amen, to hide, conceal

men, sand

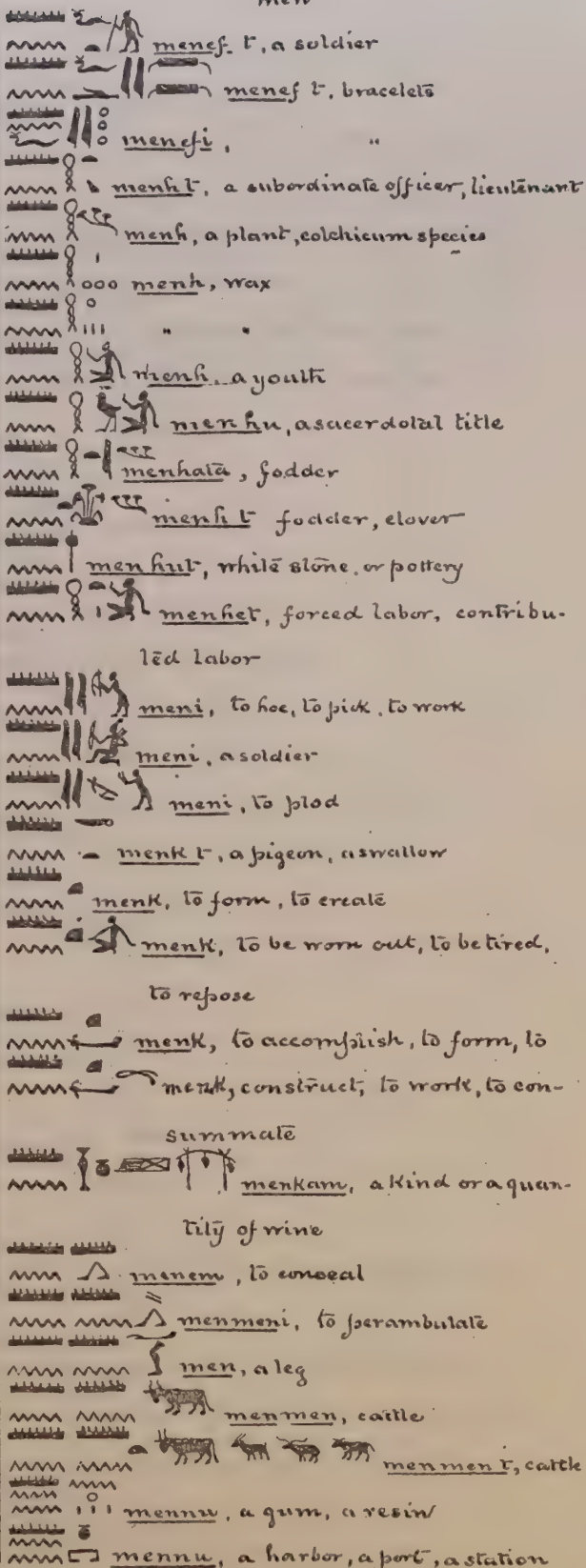

menmen t, a certain person, tel ou telle,


mena, to anchor, to warp to shore

men


mena, a pole, to anchor, to stop
mena, to arrive, to anchor
mena death
mena, driver, shepherd
mena t, a constellation of the eastern heavens
mena t, a counterpoise for the collar
mena t, burial, the arrival at the tomb.
mena t, a harbor
menau, sleep, death
menau, the table on which men were laid when tortured
menau, approach, arrive, the arrival of a vessel;
menatiu, an executioner, torturer
mena, a mine
mena t, a milch cow
mena tiu, shepherds, foreigners
mena,
menaf, rings
menefa, a soldier
menfi u, soldiers
menfi, a soldier
men nefer, bracelets

men


menef t, a soldier
menef t, bracelets
menefi,
menh t, a subordinate officer, lieutenant
menh, a plant, colchicum species
menh, wax
menh, a youth
menhu, a sacerdotal title
menhatā, fodder
menh t fodder, clover
menhut, white stone, or pottery
menhet, forced labor, contributed labor
meni, to hoe, to pick, to work
meni, a soldier
meni, to plod
menk t, a pigeon, a swallow
menk, to form, to create
menk, to be worn out, to be tired, to repose
menk, to accomplish, to form, to
menk, construct, to work, to consummate
menkam, a kind or a quantity of wine
menem, to conceal
menmeni, to perambulate
men, a leg
menmen, cattle
menmen t, cattle
mennu, a gum, a resin
mennu, a harbor, a port, a station

menennu, a harbor, a port, a post

mennefer, a collar

mennu, a place

mennulā, conform

mennu, an offering

mennu, statuleš

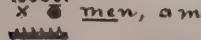
mennu, the priest who offered the sacrifices

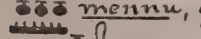
mennu't, daily, constantly

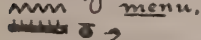
mennui, a cloth

mennu sa, a computing scribe

men, a measure of capacity


mennu, gift, monument, memorial


menu, a rope

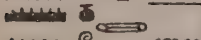

menu, an aquatic bird. upon the evil principle

" " " at Edfoo

mennu't clothes

mennulū, defects, ills

mennu, a tree, a grove

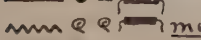

mennu, bread for offerings

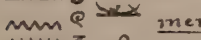
mennui, a dry goods measure

mennu, gifts

mensem, a jar of some liquid

mennu, a military post, a station


mennulū, bracelets


mennu, to arrive

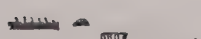
mennu, the rumps

mennui, fire

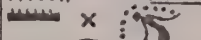
mennu hut, whilst manna, the tamarisk was sometimes so called

mennu, an instrument

mennu, part of an offering


menti, black stone, durite

mens, a flaw

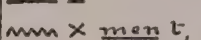

mener, incense, the perfume of incense

men't, daily, continually, perpetually

menti, the breasts

mennini, Phœnician water

men't, that which is wanting, in default of-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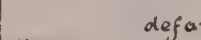
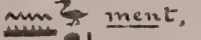
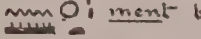
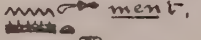

men't, bier, couch

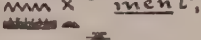
ment, a swallow

ment brown stone


men't, a counterpoise


men't, a vase

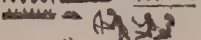

ment, a beer measure


menti, a black stone, durite

men't, groves, meadows

men't, a nurse

menti, working people, laborers


menu, rope, twine

menur, incense, the perfume of incense

menui, title of the priest who killed impure animals

menx, fabricate, work, build, execute, finish

menx, fortunate, beneficent, form, perform, create, work, execute work, propitious, proper, useful

menx, workmen

menx, clothes, garment

men

menx, clothes, garment

menx hut, while pottery

menx, utensils, things that are made

menx, clothes, garment

menxt, the mummy swathings

menxt, work, utensils

menxt, clothes, garment

menxarw, a kind of fabric, of linen, or rope

mensh, a sea going vessel

mensh, clothes, garment

menshu, a sea going vessel

menshtu, colors

menw, a fault, flaw, illness

menww, any monument which is a memorial of the past

men, memorial, gift, dedication

men, a grove

men, a plantation of trees

men, an obelisk

men, fine monuments

menui, to recollect, to remember

menxt, a pigeon

menum, buildings, structures

mennu, jars

menux utensils, clothes

mert, to put to bed

merti, the Pastor race

men, go round

men, go around, perambulate

uten, a weight, a pound

menmen, perambulate, go round

men, to go round

men

uten, a weight, a mna

mert, a circle

"

rit, midday, time, epoch

rert, a place of repose

rit, midday, time, epoch

ter, to spring forward, to dart-

rerha, to retrace the steps, to repeat

uten, a weight, a mna

mena, to pace, to go around

mer, a precious wood obtained from Assyria as part of tribute

mer, to love, to kiss, to attach, the will, friend

mer, to love; mer mountain country

mer, a magazine, a storehouse

"

mer, the eye

mer, Egypt; ta mera, the land of the Sycamore

mer, a mountainous country

mer, a precious wood obtained in tribute from the Assyrians

mer, an oar

mer, a water course, the sea

mer, a sycamore tree

mer, sycamore wood

mer, to envelope, bandage, swathe, tie

merper, a person attached to a temple

mera, a division of land, a region, a street; Tamera, a name of Egypt

mera u, agriculturists

mera r, midday

merh, wax

merh neter hebs, holy oil ?

merh r, wax

merhlēn, to anoint, to rub with an oil

merh r, wax

merhu, to daub, to anoint

merhlēn aa anru s'Kami, to anoint with (the oil of) the great black stone, used in embalmment; bitumen?

merhur, to sustain a damage

meri, the base of a triangle

meri, a precious wood

meri r, a name for the heavens

meri, a sycomore tree

meri r, the beach, a villa by the water

II merit, the beach; " " beloved

merhu, to anoint, to soak, to imbibe

merhlēn asu, holy oil, (oil of forefather, god)

merh s'Kat nu neter yat oil extracted from holy things

merh heti, thick oil, oil thickened with flour

merer t, wish, will, friends, agreeable

merer, cakes

mer u ru, Abalouli, a god

mer r, a kind of box or chest, water

mer r, a person attached to - monk

mer r, to attach, beyond

mer r, wax

mer r, a cow

mer

mert resh, the South

mert mesh, the North

mer-ti the eyes

" " "

mer r, a chest

merti, a mountainous country

merlu, attached to - a monk

meru, a package

mer-u, a watercourse

merui, was agreeable, pleased, agree

merau, a pike

maruri r, a bird

meru, a mountainous country

mer r, an inkstand

meruu r, the places, in tombs, where corridors cross each o- ther

mer ur, to suffer physically or morally

merifu-xa, the poles, ornamented with silver, used in setting up tents.

merlu, the loving ones, friends;

lennu en ef shenti enti meri tu ef. how he dwells among his friends, ie. how great he is among his friends

ma per, a magazine, a store house; Pithom and Rameses probably con tained ma peru

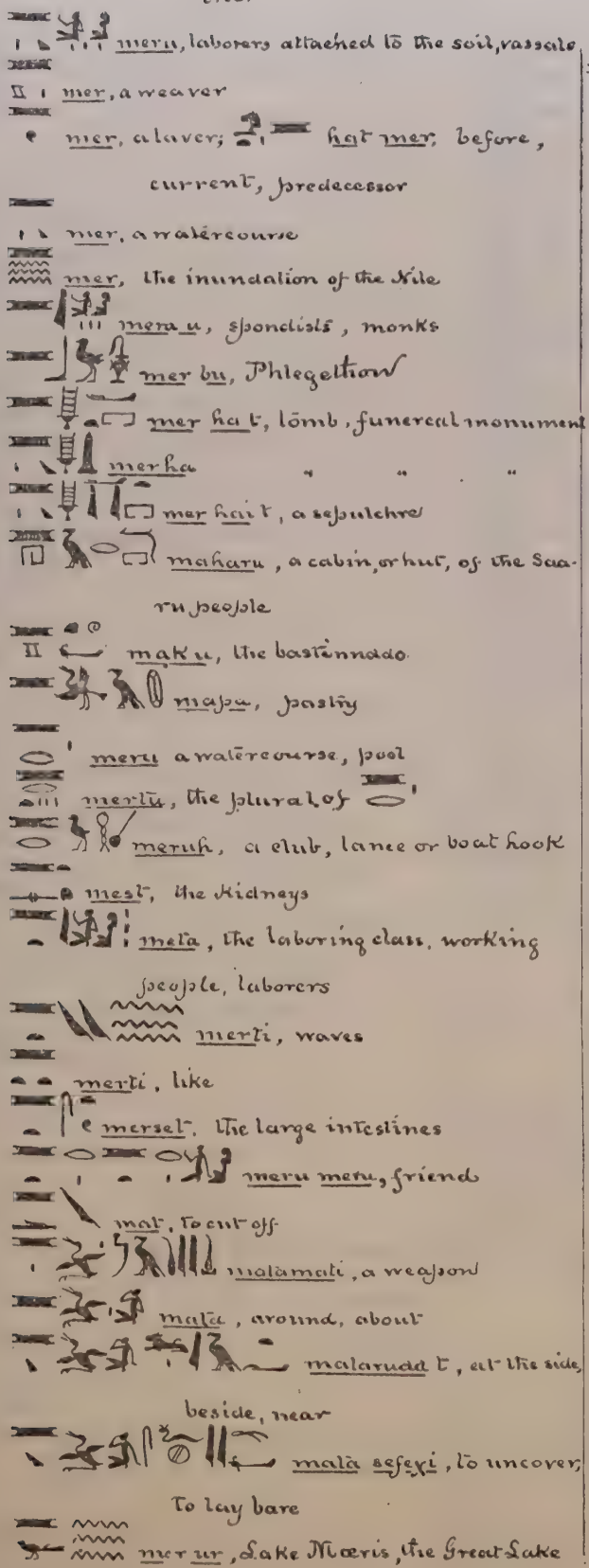
perer u, to run away, to bear off

hab, a plough

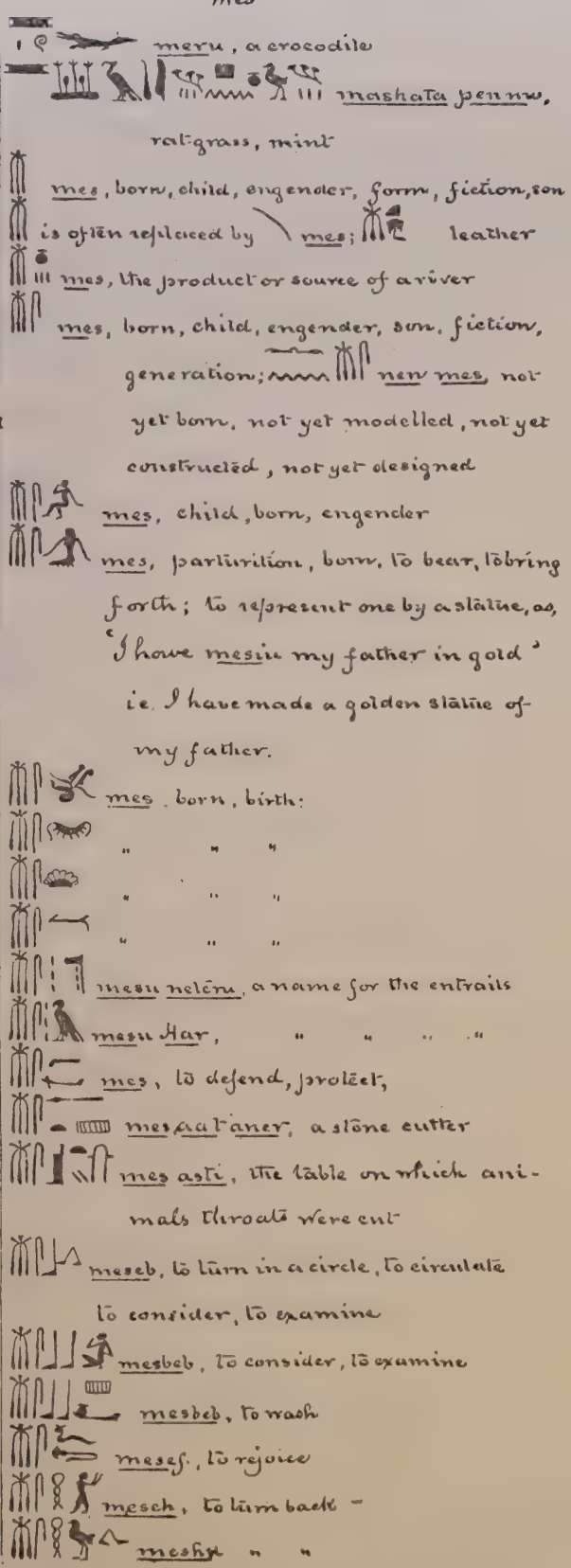
mer, a basin, a watercourse

II mer, weavers

mer


merti, laborers attached to the soil, vassals
mer, a weaver
mer, a laver; hat mer, before, current, predecessor
mer, a waterecourse
mer, the inundation of the Nile
mera u, sphendists, monks
mer bu, Phlegethon
mer ha t, tomb, funereal monument
mer ha " " "
mer hai t, a sepulchre
maharu, a cabin, or hut, of the Saaru people
makru, the bastinnado
majju, pastry
meru a waterecourse, pool
merti, the plural of
meruh, a club, lance or boat hook
mest, the kidneys
mera, the laboring class, working people, laborers
merti, waves
merti, like
mersel, the large intestines
meru meru, friends
mat, to cut off
malamati, a weapon
mala, around, about
malaruad t, at the side, beside, near
mala sesexi, to uncover, to lay bare
mer ur, Lake Mœris, the Great Lake

mes


meru, a crocodile
mashata pennu, rat-grass, mint
mes, born, child, engender, form, fiction, son
is often replaced by mes; leather
mes, the product or source of a river
mes, born, child, engender, son, fiction, generation; new mes, not yet born, not yet modelled, not yet constructed, not yet designed
mes, child, born, engender
mes, parturition, born, to bear, to bring forth; to represent one by a statue, as, 'I have mesu my father in gold' i.e. I have made a golden statue of my father.
mes, born, birth:
" " "
" " "
" " "
mesu nelenu, a name for the entrails
mesu Har, " " " "
mes, to defend, protect,
mes aa t aner, a stone cutter
mes asti, the table on which animals throats were cut
meseb, to turn in a circle, to circulate to consider, to examine
mesbeb, to consider, to examine
mesbeb, to wash
meses, to rejoice
mesch, to turn back
meshe " "

mes

emsuh, a crocodile

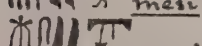
meshu, to strike with an edged weapon

mesha, to breathe joy

mesi, to defend, to protect

mesi, New years day evening meal

mesi, the rearing of birds


mesi, New Years eve

mesi, a young girl

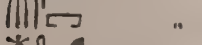
meseklu, a bracelet

" "

mesek, the place of torture

" " " "

" " " "


mesk; to train, aim, shoot, to draw a weapon

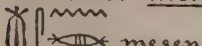
mesek, the skin the epidermis

mesek, a skin, leather, hide

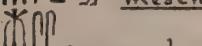
mesmes, an invention, the scheme of a building, combination, the complication of a building

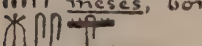
mesmesi, " " " " " "

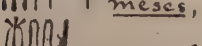
mesen, a basket for packing dates

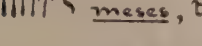

mesenlu, were born

meses, born, engender

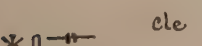

meses, a strap; meses t, a whelp


meses, to trace, to draw, to represent

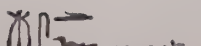

meses, to surround, to encircle, to girdle


mesbeb, to surround, to encircle

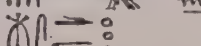
meses " " " " " " "


messu, born

mes


mest, hate

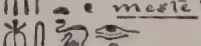
mestem, collyrium

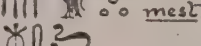

" "

mestet, hatred

mesti, color for the eyes,

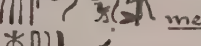
mestet, sole of the foot, the ankle


mest, collyrium

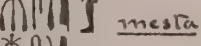

mestet, hateful

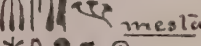
mestetu, hating

mestetu, hating

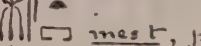

mesta, a palette

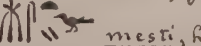
mesta, a form, a figure, an effigy


mestu, an odoriferous plant, a bouquet


mestau, " " " "

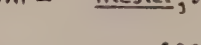
mest, place of birth, lying in chamber


mesti, hatred

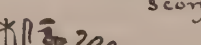

mestem, collyrium, stibium

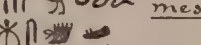
mestu, born

mestet, the constellation of the third scorpion


mestetes, the constellation of the fourth scorpion

mestu, a serpent


mester, the ears


mesteru " "

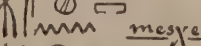
mesu, injury, degradation

mesu betshu, rebels, enemies

mesxeni, the place of the new birth

mesxen " " " " "

" " " " " "


" " " " " "

" " " " " "

mes, mut

mesxet, the thigh, the hind quarter, in contradistinction to xeṭesh, the fore quarter

mesxet, the North

mesxet, an angle.

mesxi, to breathe joy

mesxeti, the nostrils

meshew, the place of the new birth

messhet, the thigh, the hind quarter in contradistinction to xeṭesh, a forequarter

mesen, a chamber at Edfoo where the Gods were robed

mest, a diadem

mestemstibium, collyrium, Kohl

mest, hating, rejecting the law, an enemy

mest, the sexual part, end

mes xa, to breathe joy

mesek, leather

mut, mother, alone, sole,

mut, great terror

mut, the year

mutka, copper

" "

mut, a weight, a value

mut, mother

mut, the door of a pylon

nehap, to make pottery

nehar, to resemble

W.

N

en, of, by, from, to; when it occurs between the pronoun and the verb it marks the perfect tense, tat en ef, given by him, he gave; in the imperative - 1 1 1 shes. en tennu, take ye! was used instead of nen, the negative

na, an exclamative particle, well! now then!

na(xt), to prevail

na , victory

naa, a medicinal plant

nauau, " "

na, come, go; nas, towards

na " "

na, a mythologic serpent

maau, come, go

maau, a mythological serpent

mait " " "

maii, come, go

nait, a vessel or part of one

nar, a fish

nabui, fire, smoke

nas, to invoke, to adore, to address, to recite

nas, to, towards; nas en ef, to him

nas, to hail, to address

nar, water

na, to have pity, compassion

na, a house

na

na, an account

na, paint, ink, color, list, catalogue

" " catalogue, writing, state

nat, ordinance, decree, prescription

naa, paint

nab, a jar, a certain quantity

nai t, the place where the valuable articles of the house were kept and where the funeral cortège assembled

nah, a rope

nai, air

na runa, young soldiers, recruits

nat, to twist a rope, to "lay up" a rope

nalu, a fish

nalu, a spear

nalu, to contemplate

nau, a handfull, a grasp

nauit, a weapon, a sword

nau, paint

nash, power, powerful

nau, a wild goat

nau, " "

en aa, great, grand

na, the; na enti, those who- def: article sing:

naat, a residence

nai t, "

naaa nuu, the officers

nahi a signal

naha ur, dirty, unclean, ab-

na, nb

ject, enemy

nakai t, lying

na enti, those who are

naru, food

nasi, foul, vile

nasi, " "

nalayi, a lyre

nauatan, to tremble, to strive

nay, a place

naseku, paragraph, division of writing.

en abt, the East, a name of Amen Ra

nebat, a thorny or prickly plant

neb, a sledge hammer, a mallet, a beetle

neba, palm wood

nebat, fire

nebau, a seat, a chair

neba, a staff

nebbu, to float on water, to swim

" " " " " "

nebhu, a kind of flower

nebi, part of a bow, the stave of an arch

nebi, lord, master

nebit, lady, mistress

nebit, a chair, a seat

nebiu, to prop, to sustain

nebs, date tree

nebs, a date tree

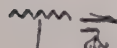
nebs, a palm tree

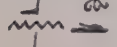
nebs, dates

nebs, dates

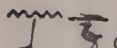
nebs, date palms

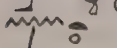
nb, nf


nebt, to plait, braid, to noose


nebt, iron work, to iron, to garnish with a metal

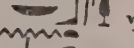
nebt, a dress or a lock of hair, to weave (conspiracies), to plot evil

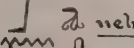

nebtu, a disk


nebtu, iron work, to iron, to garnish with a metal

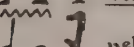
nebt, to plot evil

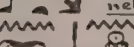
nebs, date palm


nebt, to tie, to noose, to plait


nebt, flame, smoke

nebt, evil of some kind


nub enxu, to gild

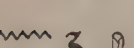

nebtu, to weave (conspiracies) to plot evil, a lock of hair

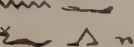
nefa, who, what

nefai, aberration

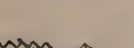
nefau, evil doing, wrong minded mischievous, to do wrong

nefaui, direction, current, tendency, motive force

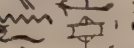

nefat, bread or cake


nefa, to run hither and thither, to be lost, to wander, to be confused,

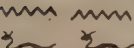
nefi, erring, iniquity, getting out of the right path.


nefi, navigation, sailor

nefiu, breath


nef nef, to run hither and thither, to get lost

nef nef, to water, to inundate


nef nef, a kind of worm or snake

nh

nefer, good

" "

nefert "

nefet, fan, flabellum

neheri, a kind of bread

nahieb, a species of lotus

nah, foul

enher, bread

en heh, eternal, eternally

naheh " "

neheow, to be cold

nehest t, a tooth

en hnh, to attack

neh, to execute, to form

nehe, a tree, a sycamore

neh, to separate, to distinguish, whence

neha, lose, few

neha, " "

nehamu, to shout with joy, to accompany on an instrument

nahamu u, rejoicers, to rejoice, enjoyment

nahani, a sycamore

neharuau, an officer, groom

nehap to copulate

nehama, a kind of fruit

nehau, a few, a little, some few

" " " " "

" " " " "

nehi, a sycamore tree

nehit, " "

nehi, Egypt, the land of the sycamore tree

nh

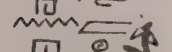
nehis, to invoke

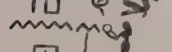
nehisiu, a little, a few, some few

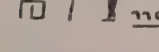
nehem, to rejoice, joy

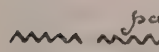
" " "

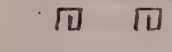
" " "


" " "

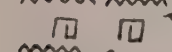

nehem, to shout with joy, to accompany with an instrument

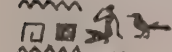

neh neh en sent, to excite


neh neh, to agitate

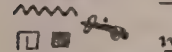

nehep to complain

nehes, to protect

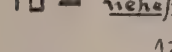

nehes, to copulate


nehesp, to chase, to conduct, to direct towards, to seize by force.

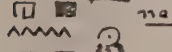
nahesp to copulate


nehesp, day, daylight

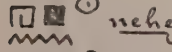
nehesp, day time


nehasp, to lament, mourning

nehespui, to lament, mourning, to bewail, a wail

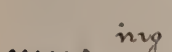

nehes, to awaken, awake, a negro

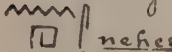
nahes, to awake, to rise up, to get up.


" " " " " " "

nehas, a rebel

" "


nehas, to awake, to rise, to get up.


nahe, to awake, to raise the eyelid

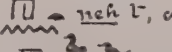
nehas, rebel, revolt, pride

nh, ni

neh t, a few, a little, some few

neh t, proportion, dimension, form

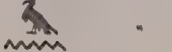
neh t, a sycamore tree


nehu, want, require, lose

neha her, a foul face

neh, to assault

" " " "

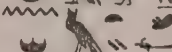

nehem to take away, to deliver

nehem, to carry off, to deprive, save

nehem, a palm flower bud

nehem, take

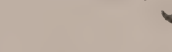
nehemti, listen


nehmu, to cry out with pain, lament

nehemu, to take away, to rescue

nehema a en reiu, I saved the people

nehem, to carry off, to deprive, to save


" " " " "

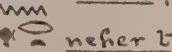
nehemt " " " "

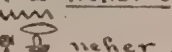
neher, a kind of food

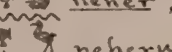
neher t, a kind of bread

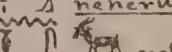
neher, " "

neherw, " "


nehas, to rebel


nit, a residence

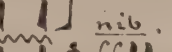

ni u, lances, spears


nib, a lance, a spear

ni ni, to sit, to rest

nif, an enemy

nif, power, strength


nif, breath, a pass, to pass

ni, to see, to look.

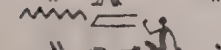
nisher, to agitate

ni, nḫ

nikau, idle, lazy

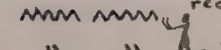
nima, who, what, which

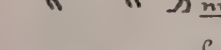
" , " " "


" , " " "

nini, to be amazed, astonished, to recognize

nini, to incline, to adore, to do homage


" " " " " "


nini, to sprinkle

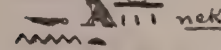
nini, flux, flood

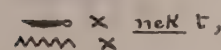
nek, to copulate, adultery

neka, thing, matter, affair

nek t, " " "

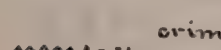
nekt u, provisions


neka, to delude, provoke, false criminal, impious, strike, afflict


nek au, objects, things

nek, to strike, to afflict

nekau, to delude, to strike, to afflict


neka u, things, affairs, matters

nekai, to delude, to strike, to afflict

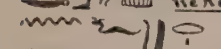
nekeb t, to wash, to refine gold.

nesitaru, an important liquor

neki, false, delude

neki, a bull

neki t, a dagger

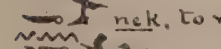

nek, to wound, destroy

neken, false, lapse, slaughter, destroy

nekeni t, a dagger

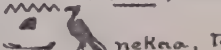
neken, false, lapse, slaughter, destroy

neken, " " " "

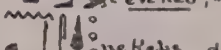

nekenef " " "

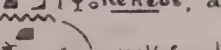
nḳ, nm

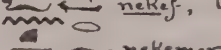
nekt, to inquire

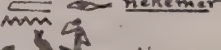

nekaa, to carry off

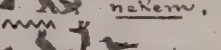
enkeb, to afflict, to sadden


nekebs, date tree

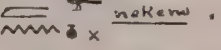

nekef, to steal

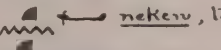

nekemer, sleep

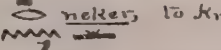

nekem, revenge, vengeance

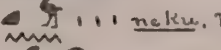

nekem, " "

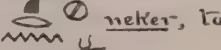
nekem, " "

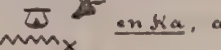

nekenu, fight

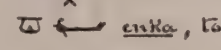

nekeri, to knead

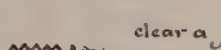

nekn, may, 'may the Gods'


neker, to sift


enka, a bull


enka, to comfort, to open by force, to clear a passage


enka, to dabble


enka, to open, to comfort, clear the way

enka, a bull

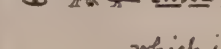
en ka, a bull, beef

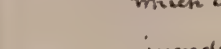
en ka, a sailor

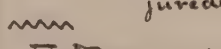
enka, that which is broken, that which is wanting, that which is injured, distinctive

nek, a curse

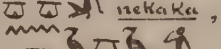
nekaka, to cackle

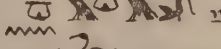

nekaka, to dabble

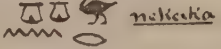

nekkaka, to cackle, to caw


neker, to sift; en maiet, question

nemaa water; en ma, who? whom

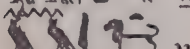

nemenu, take, remove, force


nemem, destroy


nemema, a dwarf

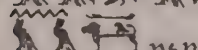
nmw

nemema, second

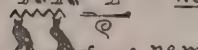

nemema t, to lie down, repose, sleep, doze

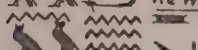
nememati, to go towards, to join

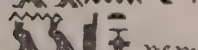
nememaa, forced, vanquished

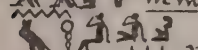
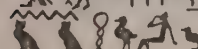

nemema, ? (repose)

nememaw, ?

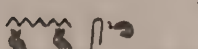

nememaw, masonry

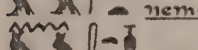

nemem, a wine press, to press


nemem, a vase, a jar


nemh w, the feeble

nememhw, the feeble, youth, the depraved

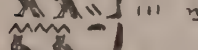
nememhw, the depraved, defeat, miserable, humble


nemems, a wig


nemems, a jar

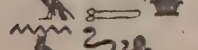
nemems, a wig

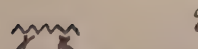
nementi, legs

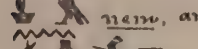

nementia, force

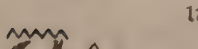
nememu, a cistern

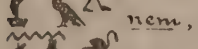
nememut, a liquid

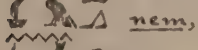

nemet, a block, the scaffold, the gallows


nemw, an oil, a liquid


nem, the place of execution or of torture

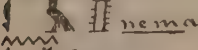

nemw, to turn back, to withdraw, to force


nem, forced


nemn, to half close the eye, to sleep

nem, to walk, to go, to go towards, to join

nema, to build, to construct


nemn, to diminish, to make or be-

nmw, nw

come smaller, infirm, miserable

" " " " " " "

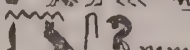
nema, to embrace, to hug, to accompany

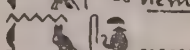
nemaw, to shake (the earth)

nehema, to execute, to torture

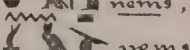
nem, the block;

nemw, to punish;

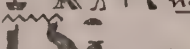

nems, a wig, a hood

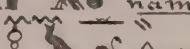

nems, a liquid

nems, a kind of food

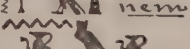

nems t, the block

nemsw, a wine press, to press


nams, a liquid, a measured


nemw, force

nem, an oily liquid, sacred oil


" " " " " "

" " " " " "

nemw, a wine press, the name of a god

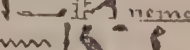
enmer, a steering oar, a rudder

nemti, to turn back, force

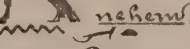
nema, to repose, lie down, to sleep

nima, who, what

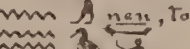
nema, to build, masonry


nehemti, the legs

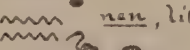
nehemw, an offering

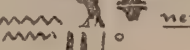

en em naxt, while, whilst

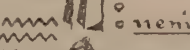
nem, to incline, to bend, to adore, to do homage


nemti, man the individual

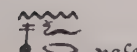
nem, like

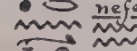

nem, a basket, a net

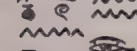

nemib, a balsam


nu, water, the essence of a god, as bread is the substance

new


nefer, good

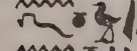

nu, water

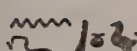

nu, to see

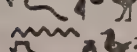
nenu, kind, sort,

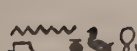
neni, waters of a canal, river or of a

nenui, to exeite, to push, to finish


nennui, to repair, to keep in good order, to take care of - to mend, a police.

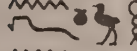

nenanu, to defile


nenw, to lead, to induce people to do any thing, to induce them to compose or to act on anything, "to make heaven tremble"


nenushi, horns or antennae

nenuk, to shake, agitate, masturbate

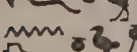
nenuk, to execute


nennuhu, tree

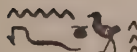
nenuhu, to shake, to toss

nenuhuw, monuments

nennu, tribute

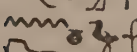

nenw, to see, to look

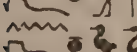
nenu, to go, descend, attend to, to repair, to dispose


neniw, water

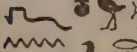
nenu, time, epoch, moment, continually

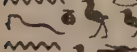
nenu, an order of gods


" " "


nenu, a bird, a vulture

nenu, these, those, that


nenuru, a vulture

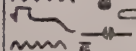

nenut, cooking material

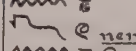
new

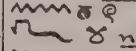
nenish, to be drunk, to be intoxicated, to be drunk with joy

nenuh, arase

nenus, a ring

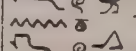

nenu, these, those, that,

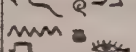

nenw, a garment, to dress

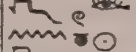

nenw, the inundation

nenu, the name of a bird

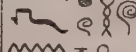
nenu, to descend, go, follow, walk

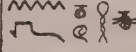

nenu, to see, to look


nenu, continually

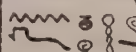

nenuh, a rope

nenish, drunk, to be intoxicated with joy


nenushu, to shake, to agitate, to masturbate

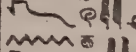

nenuiu, to defend

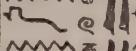
nenui, in good condition, in repair

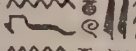

nennu, water

nenut, emotion, agitate

nenut, to cook

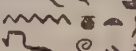

nenuti, "


nenut, a cook

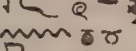

nenw, a rope

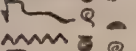
nenut, "

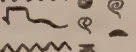
nenu, "

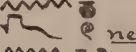

nenui, a serpent of Hades

nennuti, to tremble, to shiver

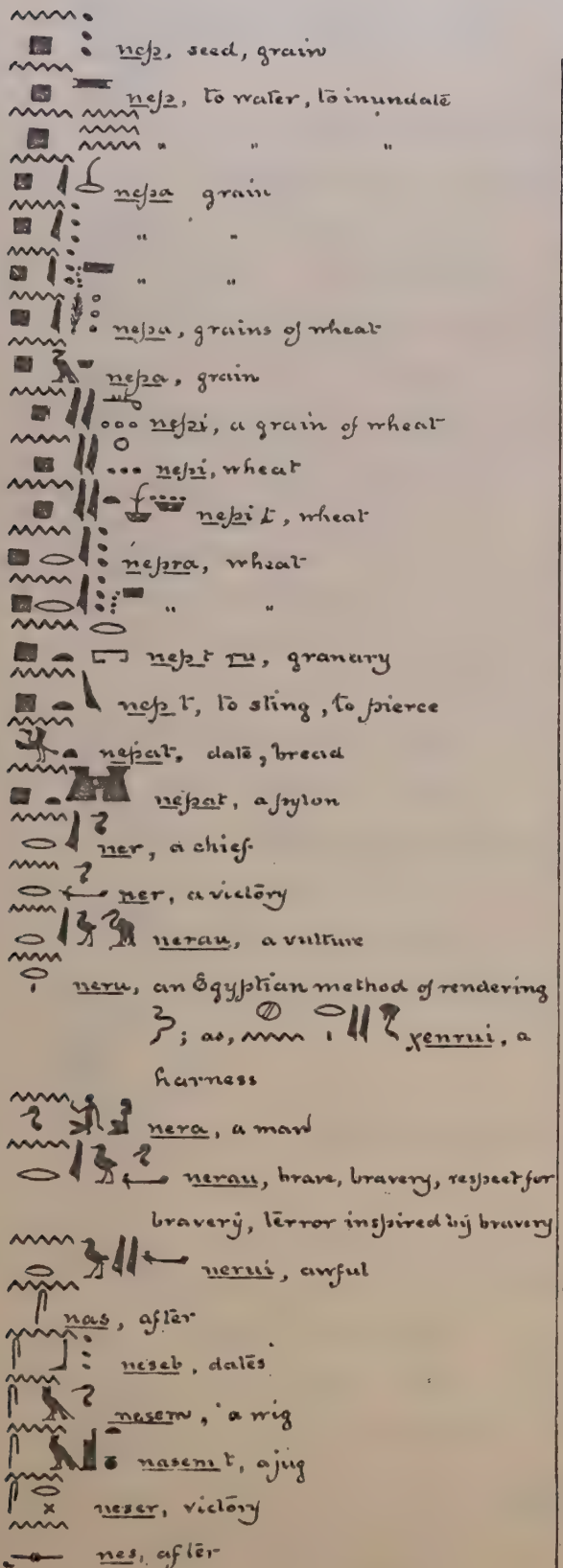

nenu, a certain quantity of land or water

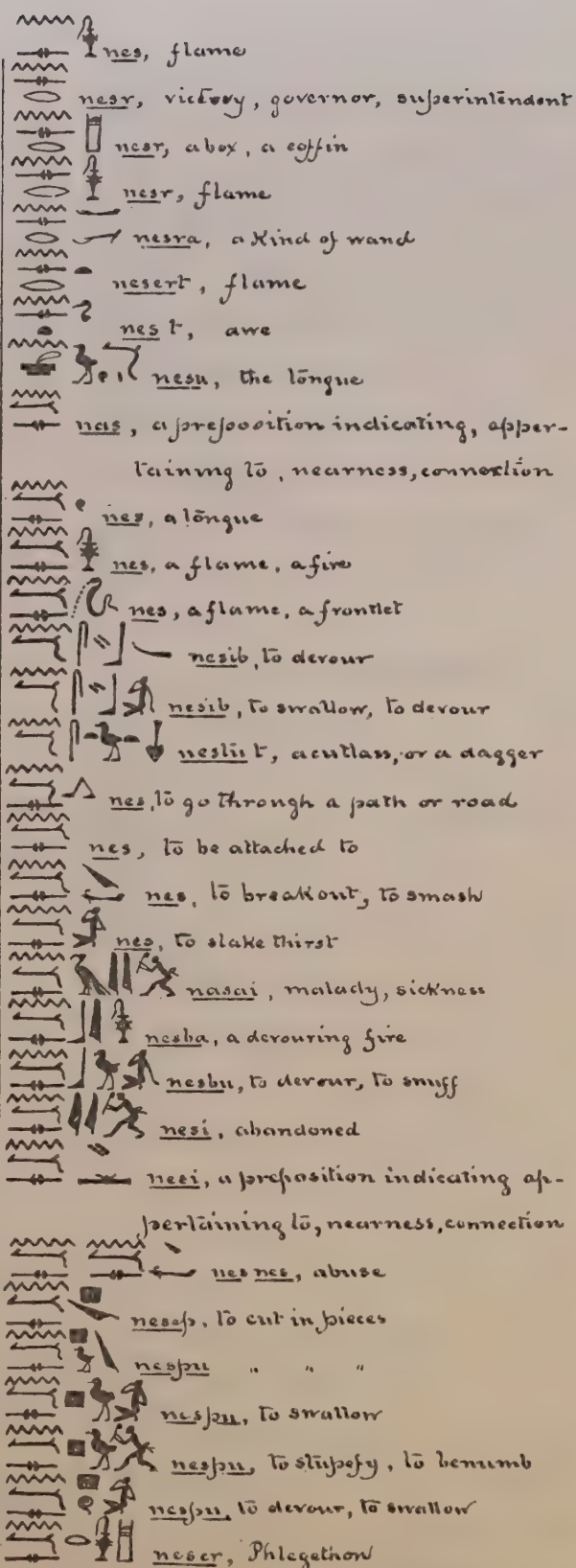

nenut, a kind of linen

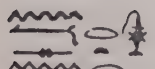

nenu, to go hither and thither

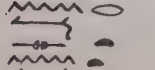

nenehu, to knot, to twist

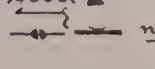
nesh, to sow seed, seed, inundate

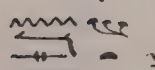

nesh, seed, grain
nesh, to water, to inundate
" " "
nesha grain
" "
" "
nesha, grains of wheat
nesha, grain
nesha, a grain of wheat
nesha, wheat
nesha t, wheat
neshra, wheat
" "
nesh t ru, granary
nesh r, to sling, to pierce
neshat, date, bread
neshat, a pylon
ner, a chief
ner, a victory
neraw, a vulture
neru, an Egyptian method of rendering
3; as, xenrui, a
harness
nera, a maul
neraw, brave, bravery, respect for
bravery, terror inspired by bravery
nerui, awful
nas, after
neseb, dates
nesemw, a wig
nasemt, a jug
neser, victory
nes, after

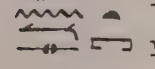

nes, flame
nesr, victory, governor, superintendent
nesr, a box, a coffin
nesr, flame
nesra, a kind of wand
nesert, flame
nest, awe
nesw, the tongue
nas, a preposition indicating, appertaining to, nearness, connexion
nes, a tongue
nes, a flame, a fire
nes, a flame, a frontlet
nesib, to devour
nesib, to swallow, to devour
neshi t, a cutlass, or a dagger
nes, to go through a path or road
nes, to be attached to
nes, to break out, to smash
nes, to slake thirst
nasai, malady, sickness
nesha, a devouring fire
nesbu, to devour, to snuff
nesi, abandoned
nesi, a preposition indicating ap-
pertaining to, nearness, connection
nes nes, abuse
nessh, to cut in pieces
nesshu " " "
nesshu, to swallow
nesshu, to stupefy, to benumb
nesshu, to devour, to swallow
neser, Phlegethon


neser t, a flame, a fire

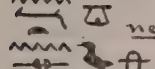

" " "


nes t, a preposition indicating ascertaining to, nearness, connection

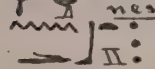

nes t, a kind of Lotus

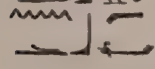

nes t, a bench, a seat, a kind of chamber, a lodge

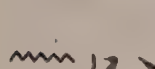
nest, a stick, an unit of measure


nes t, a seat, a bench,

nest, behind

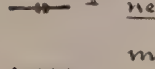

nesu, behind, after


nebu, dominion


nebt, to iron, to garnish with a metal, iron work

nebu, districts

nelef, to spit, to moisten

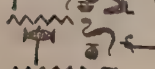

nelēs, little, inferior, mediocre, timid, young

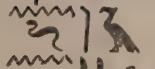
anet, salute, Praise, homage, glory (Glory be to thee Amen-Ra ve)

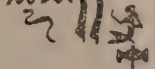
" " " " " "

" " " " " "

net to knead, pound, mill, bray

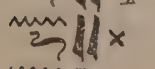

" " " " "

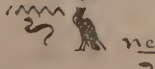

nelā, a subject

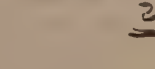

neti, a subject, from the root anet to do homage

entih or enhut, a risk

neti small, minim, inferior


neti, help

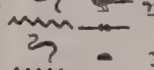

nelēm, soft, sweet;

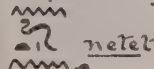

benr nu nelēm lēt, sweet mouth soft words.

neti, small, minim, inferior

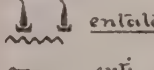
netih, or enhuti, risk

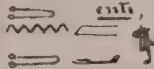
net, small, minim, inferior

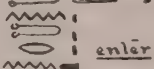

nelē, " " " "

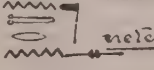

nelēt " " "

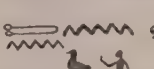
nelēt, submission

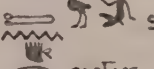

nelū, little, less

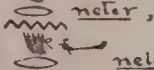

enlālā, inundation

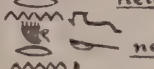

enti, out of.


anlēnma, to lie asleep


enlēr u, horses


nelēr, a God

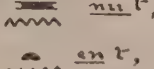

en lēsen, they (fem: plur:)


en lūa, I am

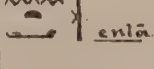
nelēr, work, plane, cut

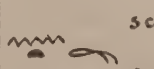
nelēr, work, strike, beat, pull down

nelēr, to plane

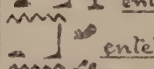

nelēra, a carpenter

nelēran, to make, to cut


nelēr, time,


nu t, water, liquid

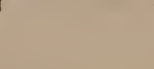
en t, of, who, which, that, on


enlef, to wrap, to envellope

enlā, ordinance, prescription, prescribed, decree, compact, treaty, debt

enlēl " " " " "

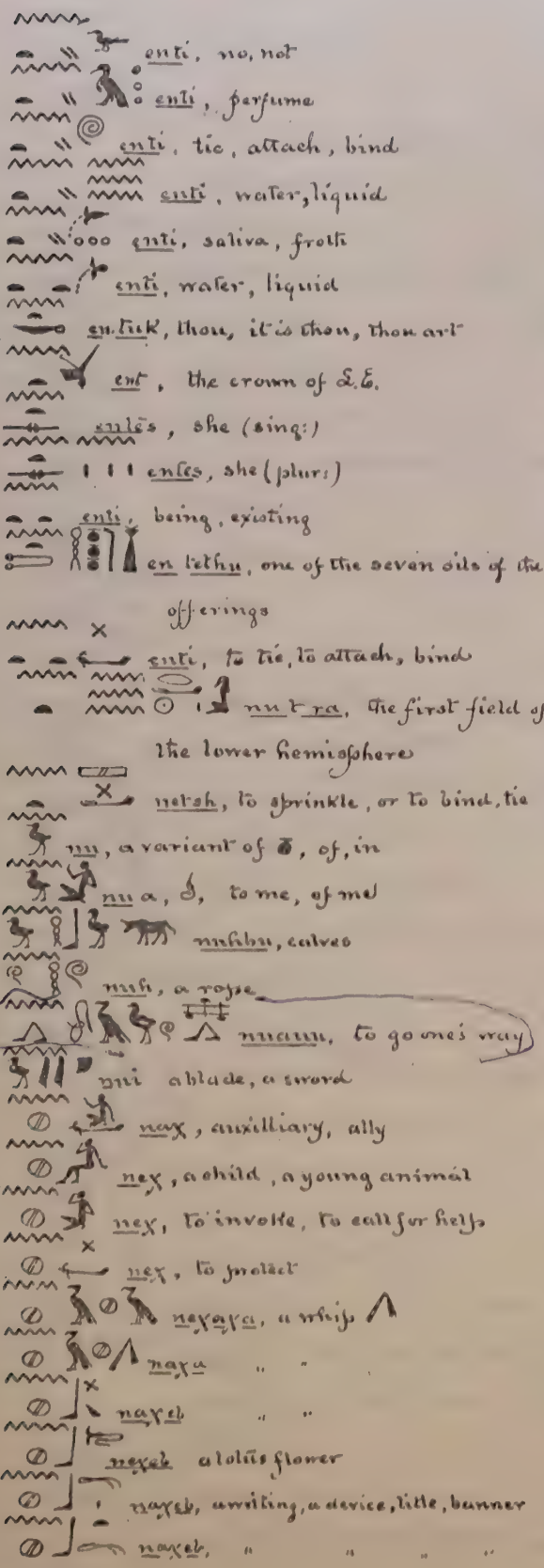
enlēb, smoke, flame

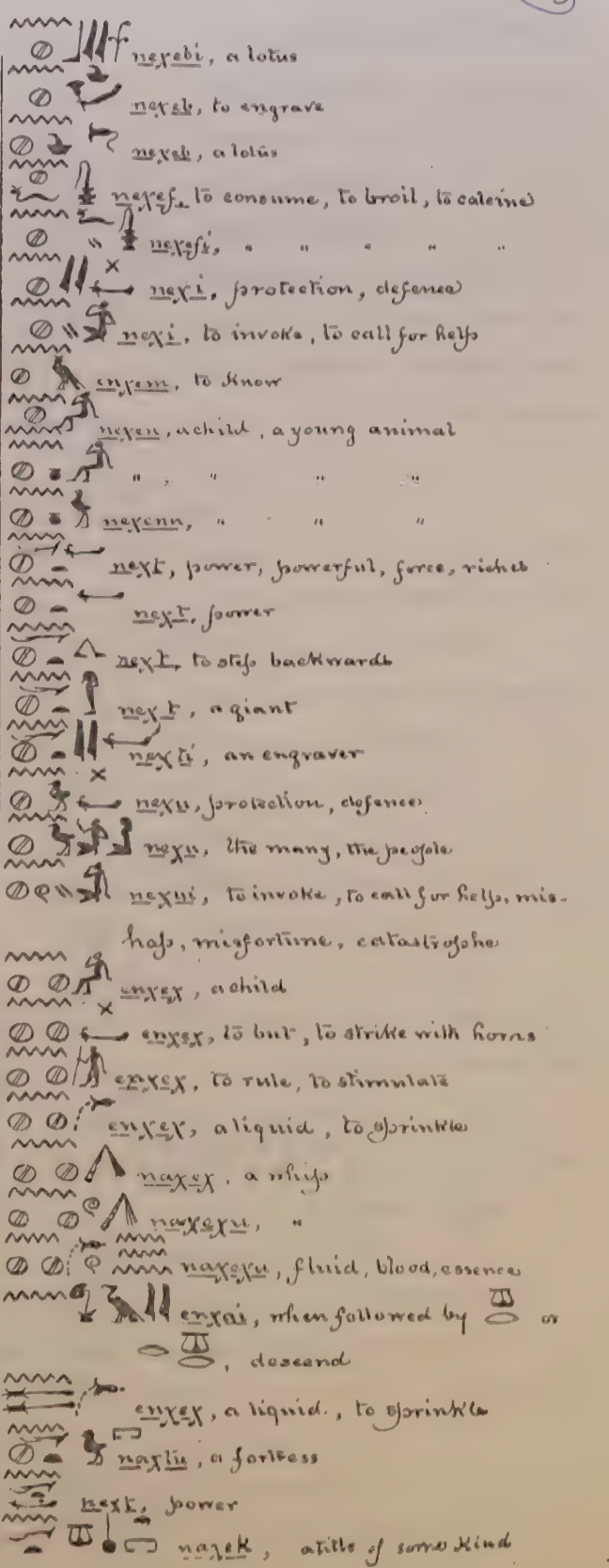

enlēb, to listen

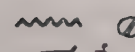
net, an enemy

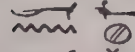
ent, of, who, that;

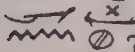
ma enti hna ek, who being with thee? who is he that is with thee.

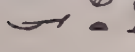

enti, no, not
enti, perfume
enti, tie, attach, bind
enti, water, liquid
enti, saliva, froth
enti, water, liquid
entek, thou, it is thou, thou art
ent, the crown of L.E.
entes, she (sing:)
entes, she (plur:)
enti, being, existing
en hethu, one of the seven oils of the offerings
enti, to tie, to attach, bind
nu t ra, the first field of the lower hemisphere
netsh, to sprinkle, or to bind, tie
nu, a variant of n, of, in
nu a, ȝ, to me, of me
nnhhu, calves
nish, a rope
nuam, to go one's way
nui a blade, a sword
nex, auxilliary, ally
nex, a child, a young animal
nex, to involve, to call for help
nex, to protect
nexaȳa, a whip
naxa
naxsb
nexek a lotus flower
naxsb, a writing, a device, title, banner
naxsb, " " " "

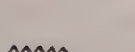

nexebi, a lotus
nexeb, to engrave
nexeb, a lotus
nexef, to consume, to broil, to calcine
nexefi, " " " " "
nexi, protection, defence
nexi, to invoke, to call for help
enxem, to know
nexen, a child, a young animal
nexenn, " " " "
nexet, power, powerful, force, riches
nexet, power
nexet, to step backwards
nexet, a giant
nexti, an engraver
nexu, protection, defence
nexu, the many, the people
nexui, to invoke, to call for help, mishap, misfortune, catastrophe
enxex, a child
enxex, to butt, to strike with horns
enxex, to rule, to stimulate
enxex, a liquid, to sprinkle
naxex, a whip
naxexu,
naxexu, fluid, blood, essence
enxai, when followed by n or n, descend
enxex, a liquid, to sprinkle
naxiu, a fortress
nexet, power
naxek, a title of some kind

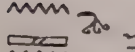

nekt, power

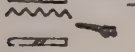

nek, "

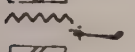

nekt tā, hard land, a field sown with corn

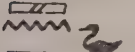

nesh, to terrify

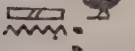

nesh, the holes of the nostrils

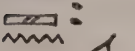

nesh, strong


nesh, to leap


nesh, to winnow


nesh, the salient part of a house, the portal


nesh, to undergo, to submit to-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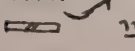
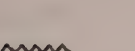
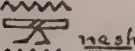
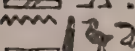

neshau, to terrify

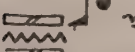

neshet, a liquid


neshef, venom, poison

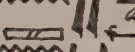
neshi, a braid, to braid, a plait


neshi, to defend

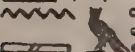
neshem, green felspar


neshem, a boat, the sacred barge

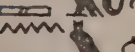
neshem " " " "

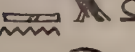

nesh, arib

or the barge Neshem

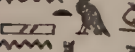

neshemt, a sacred barge

neshen, youthful


neshen, opposition


neshen, to pluck a bird

neshen, oppose, contend, storm


neshen, cruelty, a scourge, fatal, woe, fiery rage, plague, revolt

" " " " "

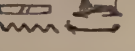
neshni, calamity, disaster, scourge, evil, fury, contend, oppose, quarrel, furious;

Heqet neshni tā, Hecate in her destructive fury.

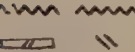
neshen, oppose, contend

neshen, quarrelsome

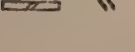
neshni, oppose, contend, storm


neshen, to spread terror, terrible, woe, terror, calamity, scourge, misfortune, wound, blinding, darkness

" " " " " " " "


neshesh, to blow

neshesh, to be seized with horror, to be agitated, startled, thrilled


neshesaw, a peacock

neshet, a lady's maid, hairdresser

neshmem, a liquid

neshr, to vex, to disturb

neshet, strong, force

neshet, a sacred barge

neshti strong, force

" " "

neshti, terror, terrible, scourge, woe, calamity misfortune ve

nesh, flower pots

neshuanauw, to exclaim, a supplicant, poor

neshesh, to destroy

neshesh, to paddle, to walk

nem, the name of a stair-

en, the red crown of Lower Egypt; of

from, by, to

na, a talisman

na, water, a wave

naha, foul

nai, to descend

nai, flowers

nahru, a torrent

neb, lord, master

nebet, bones, muscles

nehem, to rejoice

nehes, to awake, to arouse

nemma, rejoice, sleepy, lie down

" " " "

nas, the red crown of Lower Egypt

sulēn erpai, a Chancellor

neber, flame, fire

neter, a god

neter, a fluid, an element, seed

neshen, to quarrel, to contend

nas or het, the white crown of Upper Egypt, light, splendor, illumine

nas, the white or silver crown of Upper Egypt

neb, lord, master, all, every, whatever

neb anx, the cover of the wooden

" " " mummy case

neb as, precious, all noble

nebs, dates

neb t, lady, mistress; neb t ha, Nephthys, the mistress of the house

neb t sa, a protectress

neb t sa, a protecting goddess

neb tai, Lord of the two regions, Lord of Upper and Lower Egypt

nub, gold

" or nub or nubi, gold

nub, to form jewels, to cast statues jewels re

nub, to swim to float

nubi, " "

nubi, an unknown mineral or vegetable

nubi, to gild

nub hut, white gold, silver

" " " " "

nubti, a vase

nub, to construct

nub hanti, the golden reward, sacred gold, a reward for bravery

nubau, to construct golden jewels, to cast statues, ornaments re

nubu, to cast, to model.

nubu, gold

nub heh, a plant or a flower

nefer, good, perfect, merit, fine, elegant; idiomatically it means to finish, to complete; (par excellence) Osiris,

nefer em ru

Jan ban, good or bad, see

nefer, youth fit for military service

nefer, a plant

nefer hati, kind hearted, kindness, benevolence, goodness

nefer, to be able to- to attain, to finish, to end, to complete, to perfect, good, fortunate, excellent, to protect, embellish, charm, please, pleasant

nefer her, handsome

nefer, a young man

nefer, handsome

nefer, a young horse

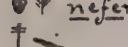
nefer, a door

nefer, warmth

nefer, the burning heat emitted by Sekhet which consumed

nefer het, the beautiful crown, the crown of Upper Egypt

nefer, a stalk of wheat


nefer, a phallus

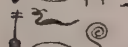
nefer, a stalk of wheat

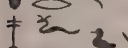
neferi, see

neferi, a couch, a bench

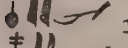
neferi, to bless

nefer, a rope


see


neferit, a lyre

neferi, a column


" "

neferiu, children

neferu, beauty, splendor, perfection

neferu, youth

neferu, hall of perfection, sarcophagus room in a tomb

neferu, a holiday garb

neferet, goods

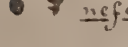
neferet, a young girl

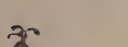
neferti, to bless

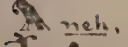
neferet het, the white, the silver crown of Upper Egypt

neh, to drag, to annihilate

neh, to agitate


neh, to vow to request

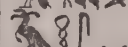

nahhet, to sustain, to nourish

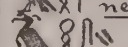

nahhu, " "

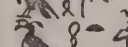
naheh, an oil

nahehw, to have faith, believe, confidence

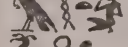
nehi, to request, a vow

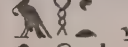

nehes, active, exile, revolt, a negro


nahsi, negro

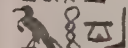

nehi, to sustain, to nourish

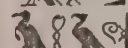
nehi, confidence, belief, to have faith

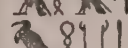

neh, the neck

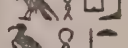

neheb, "

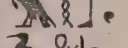
nehhheb, a serpent, a python

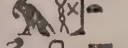

nahau u, wishes, vows

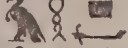

nehhheb, a serpent, a python


neheb, the neck

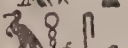

" " "

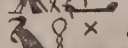

nehes, to mould, to form

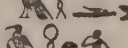

nehes, to mould as a potter

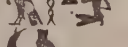

nehes, to stretch

nehet, confidence, belief, to


" " " have faith


nem, again, repeat, see, perceive

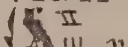

nem heb, a second festival

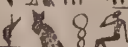

nema, to embrace, to hug, to strain

nemu, reservoirs

nemh, desperately

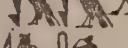
nemnemu "

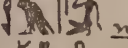

nemnem, renewed prosperity, -lium, re-


nemes, to provide oneself with

nemes, a wig

nems, a jug or liquid


" " "


nemti, to vanquish, to force

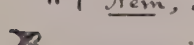
or III nemt, footsteps

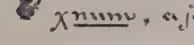
nemu, repeat

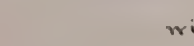
nema, repose

Nem, Num, the god Chnumis,

xnumu, a jar, to join, to attach, to unite with, to guide, accompany, to arrive at- to direct, to join

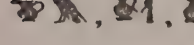

xnum, are variants of the above

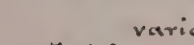

xnum, a companion


nu, water

nu, "

xnum, to build, construct, an architect


num, a cistern


" "

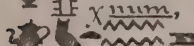
xnum na, to defend, to protect

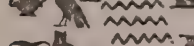
xnumt, an associate, a companion, a coregent

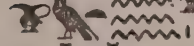
xnumu, a profession

xnum ur, a circle

numti, well, cistern, tank


nem, guide direct

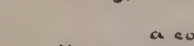

nemt, a cistern, a reservoir

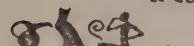

nems, to guide, direct

xesmesti, the nostrils

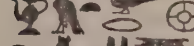
xnumt, to direct, to join

nem, sweet, delight, rejoice

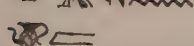

nemem, delicious


nem nem, debauch, engender

nemem, depraved, debauch


nemt, a jar of sweet water

nemi hati, kind hearted


nemti, the legs, to retreat

nen, no, not, without, a negative

nen, when placed at the beginning of a sentence is not always a negative, but is sometimes positive or relative

nen, no, not

nen t ur, ignorant, fool

nen, a sanctuary

nen t, no, not, a negative:

nen uxt na u hati-u memek

are not hearts swollen with thy love?

annu nefer, nen neshmi am su.

Fortunate hour, nothing evil in it.

nen as, if it is not so.

nen, ju r, never

nen ur, zero

nen s'rut ef, the barren region, the mysterious region

nenti ahtu, a pasture for horses

nen, like, form, those, those that, that, or

" " " " " " "

na em hru, one of these (or those) days; her sa nen, after that-

nen, alikeness, to resemble, a statue, a portrait

nen, resting time

nen, assent, relax, abject

nen, neglect, idleness

?

nen, inactive, relaxed, feeble, deficient

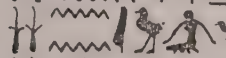
nen miserable

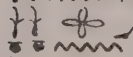
nen, a garment, a dress, to dress

nen, nas

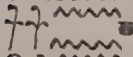
nen, a place

nennu, Gods, types, same Gods


nenau, miserable, abject


nenan, to be in, to inhabit

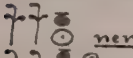
annu, an ointment jar

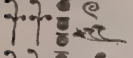

" " " "

nennu, a widow

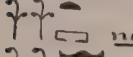
nennu, fellows, males

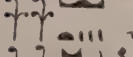
nennu, abject, miserable

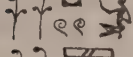

nennu, the appointed time

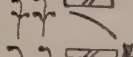

nennu, flowers

nennu abject, miserable

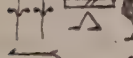

nen t, house, receptacle


nennu t, countries


nennu, fellows


nenesh, a rib,

nenesh, a rib,


nenshem, the spleen

or
nas, the tongue, a superintendent; later than the XIXth dynasty it meant any public functionary: it is also a preposition, belonging to, of, appertaining to, connection, near, neighborhood; to be attached to-

nas, the tongue

nas, attached to-, behind

nas neter$^{han}_{A}$, superintendent of priests

nas setu, superintendent of foreigners

nas xet commander of a fortress

naseh, limb

nas, a block of lead, a weight

naser, superintendent, captain, chief of-

nas ru, " " "

nas, net

nashu, to lick

nas, the tongue

nas, " "

net, or anet, hail!, praise, bow, help, glorify

" " " " " "

net, all, every thing

net, to render homage, to glorify, praise

net her, present, tithe, offering

net t, to pound, to braise in a mortar

net, a ritual, formula

net, flour

net net, to chat, to organise, to converse, eloquent, persuade

net ru, explain, discourse, advise

net, to pound in a mortar; to triturate

neti, to incline, bow, praise, hail!

net, to praise, to do homage, to salute, to protect, to defend;
net a her ek, I do homage to thee,

net, to protect, to do homage, praise

net, a present, a tribute, an offering

neti, to praise, to glorify, to adore

net net, to chat, to converse, persuade

net ru, to explain, to argue, to discourse, to advise, to deliberate

neti, to weave cloth, tissue

netnu, to defend

netu, flour

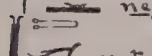
net, to praise, to glorify, to adore

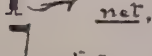
neti, that which is brayed, pulverised

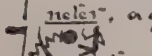
net xertu, salutation, to salute;
nak net xertu ek, I salute thee

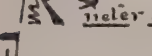
nas, a hammer

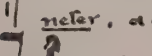
nexṯ, to counsel


neṯ, a shuttle

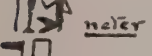

neṯer, a god, divine

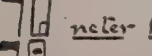

neṯer ab, a divine purifier, a priest


neṯer, a god: neṯeru sesenu, the eight gods

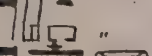

" "

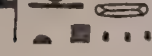
neṯer han, a prieṣt, a prophet, high priest

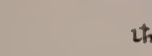

neṯer ha, a temple

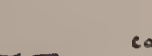

neṯer ha ṯ, "

" " "

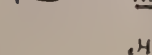

neṯer heṯep ṯ, things belonging to the temple, holy things, things dedicated to the Gods, offerings


neṯer xar, the divine inferior regions, Hades, Hell, the infernal region, the necropolis.


neṯer xarṯi, " " " " "


neṯer xar, " " " " " "

neṯer xarṯi, a mason, a sculptor, one employed to keep a temple in repair


" " " " " "

" " " " " " "

neṯer xar, Hades, the necropolis

neṯer xarṯi, a sculptor or mason of the temple

neṯer sa, a servant, a priest

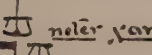
neṯer sa, priest's servant

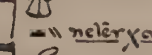
neṯer sfer, incense

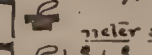
neṯer ṯa, a Goddess, a kind of priest

neṯer ṯ, " " "

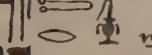
" " "


" " "


" " "


" " "

" " "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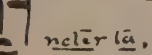

" " "

" " "

" " "

" " "

" " "

" " "

" " "

neṯer haṯ, a chapel

neṯer ṯ, a Goddess

neṯer ṯa, God land, Holy land,

neṯer, a God

neṯeri ṯ, two Goddesses

neṯer, to grow, to flourish perpetually

" " " "

neṯeri hebs, feast of the night of the 25th day of the month of Choiak

neṯeru, the stellar gods

neṯer hau, time

neṯer hut, a sacerdotal title

neṯer ṯ, a goddess

neṯer ṯi, the two goddesses

neṯer hau, time

neṯer hau Amen, a worshipper of Amen

hud ṯ neṯer, the planet Venus, (or the Phoenix)

neṯer hauu, time

neṯer haṯ, a temple

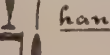
neṯer ku, to renew oneself (god like),

hudi neṯer, god star, planet Venus

han neṯer, a prophet

neṯer han, "

neṯer han ṯ, a prophetess


neṯer xamer, a priest of the sanctuary who entered the sanctum to take out, and replace, the image of the god at the time of processions

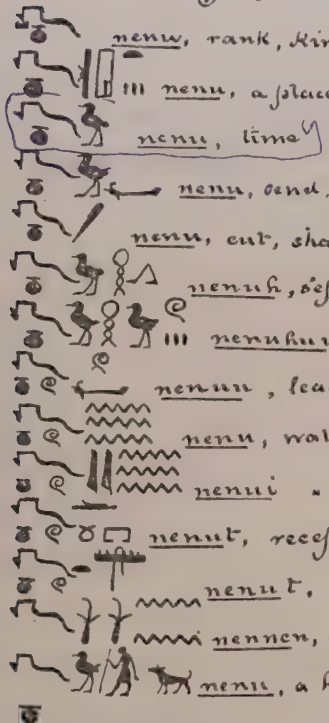
neṯer shera, " " " " " "

" " " " " " " "

nu, a drill, like, similar, like; a metallic instrument with which the ceremony of 'aṗṛu', opening the mummy's mouth

nen, nw

was performed



nenw, rank, kind, sort

III nenu, a place

nenu, lime

nenu, send, return

nenu, cut, sharpen

nenuh, to separate

III nennuhu, noses

nennun, lead

nenu, water

nenui "

nenut, receptacle, a place

nenut, a receptacle

nennen, rank, order, kind, like

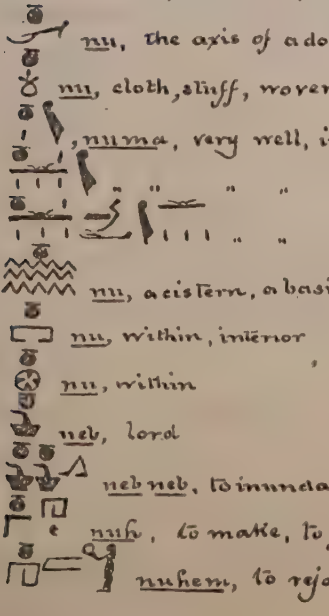
nenu, a huntsman

nu, a preposition, of, in; also used to denote ordinal number, as, II, II, 2nd, 3rd

nu, well, in good condition, goodness

" Kindness

nu sen, the other, a second, two, 2, neighbor, comrade, likeness



nu, the axis of a door

nu, cloth, stuff, woven materials

, numa, very well, in perfect condition

" " " " " " "

" " " " " " "

nu, a cistern, a basin

nu, within, interior

nu, within

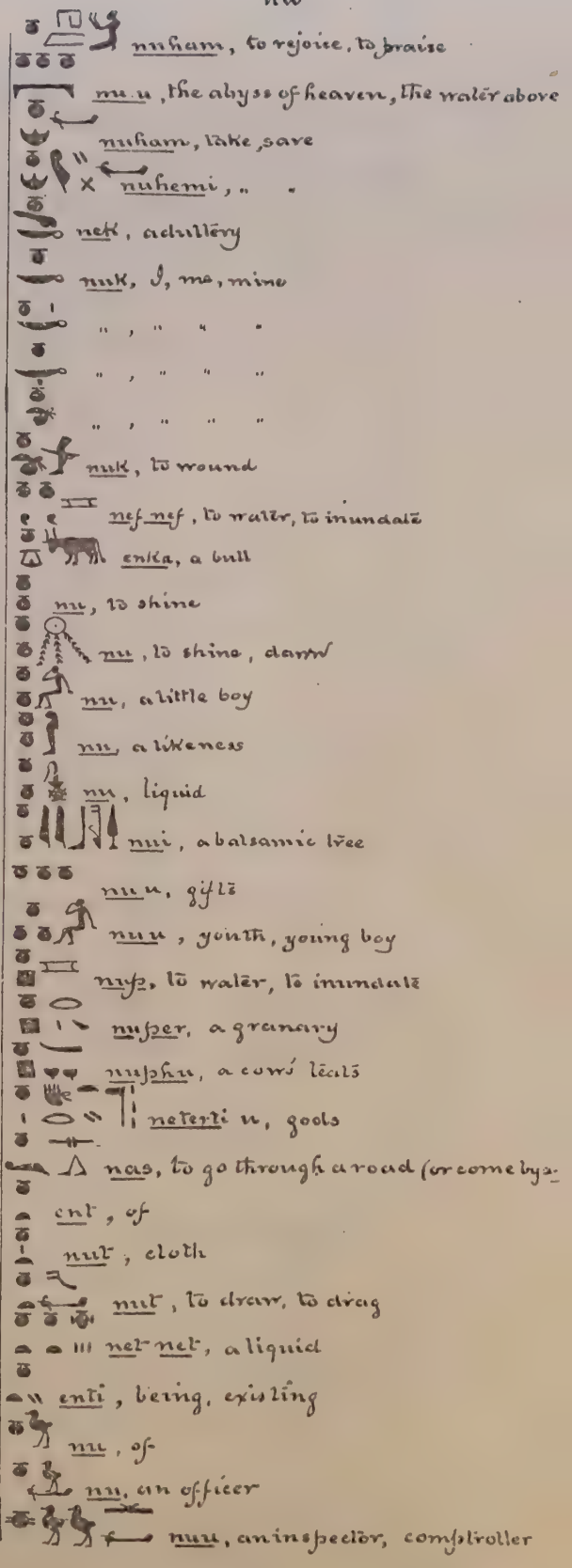
neb, lord

neb neb, to inundate

nuh, to make, to form

nuhem, to rejoice, joy

nw



nuham, to rejoice, to praise

nu u, the abyss of heaven, the water above

nuham, take, save

nuhemi, " "

nek, artillery

nuk, I, me, mine

" , " " "

" , " " "

" , " " "

nuk, to wound

nef nef, to water, to inundate

enka, a bull

nu, to shine

nu, to shine, dawn

nu, a little boy

nu, a likeness

nu, liquid

nui, a balsamic tree

nuu, gifts

nuu, youth, young boy

nufs, to water, to inundate

nufser, a granary

nufshu, a cow's teats

neteri u, goods

nas, to go through a road (or come by)

ent, of

nut, cloth

nut, to draw, to drag

III net net, a liquid

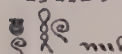
enti, being, existing

nu, of

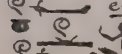
nu, an officer

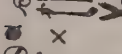
nuu, an inspector, comptroller

nuu, a magistrate


nuh, a rope

enteh, to spit, to moisten

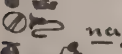

nuu, comptroller

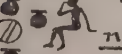

nax, power

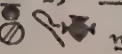
" "

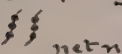
naxi "

naxeb "


nexen, a baby


nax hati, bold


netnet, to rejoice

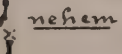

nehem rejoice, soft, sweet

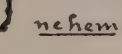
nehemti, paces, steps

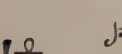
nehem nehem, the pleasure of love

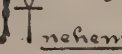
nehem, again, renew, exceptionally

nehem, again, anew, repeat, reiterate repeat


nehem anx, new life, renewed life, the second birth, the resurrection of the soul. A name given to the Nile on account of its vivifying inundations.


nehemu, a sub-lieutenant


nehem, the tongue


nehem, repeat, again

nehemtiu, second, comparable

nehem, again, twice, second

nehem, a jug of water

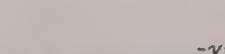
nema, to embrace, to hug, to strain

nemu, reservoir

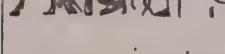
nem nemu renewed prosperity, renewal

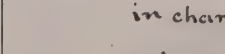
nems, to provide oneself with

nut, deity, locality, a region, a province

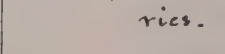

nehem hebs hru. The person in charge of articles used in the panegyrics. The feast day returner, i.e. the recorder of festivals

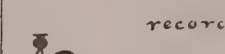
ant, revenue

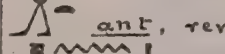

annu tribute

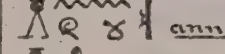

an Har, Horus

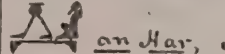
P

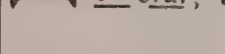

or pu, a shutter, or a mat


pu, an article, the, the number sixty, 60

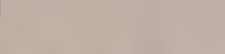

p'aanu, to surround


paau, mortals

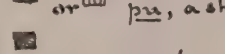

pa, ancestor, ancient

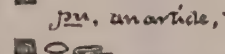

pa, the frontier, demarcation line

pai, " " " "


paapa, brilliant, resplendent

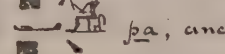
pa, heat, bake

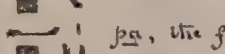

paatu, the mortal race, human beings; Patu, the assembly of mortals

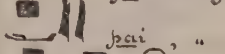

paat, men, human beings

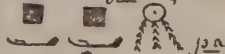
pa, man

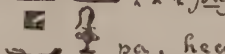
paapa, to breed, parturition


paatu, mankind


pa, the disk of the Sun


paapa, to produce, parturition


paapa, brilliant, resplendent


paabu, " "

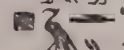
paapa, to produce, parturition

pa aur, the Nile

ḫa, ḫaḥ

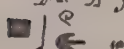
ḫai, this

ḫaḥ, all clean fowl


ḫaḥuti, handsfull

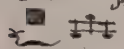
ḫat, to tread

ḫat, to tread, (apt)

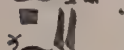

ḫabu, ?

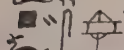
ḫef, breath

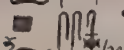
ḫefi, the

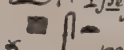

ḫef, road, path

ḫefai, this


ḫefi, "


ḫefis, ?

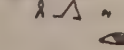

ḫefses, to bake, to cook


ḫefes, to cook, to light

ḫeḥ, to follow up, to penetrate

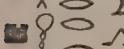
ḫeḥ, an end, a conclusion, term, to reach a period, to reach

" " " " " " " "


ari ḥ ḫeḥ, to make an effort, to use strength

ḫeḥi, rump

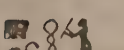
ḫeḥrer, courier, run

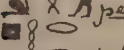

ḫeḥer, to run, a warrior

ḫeḥ ḥ, glory;

ḫeḥti, to be strong, valorous, robust, to dominate, to be powerful, mighty

ḫeḥ ḥ, to make an opening, to break in, to make a hole


ḫeḥ, to pursue, to penetrate


ḫeḥrer, to cure, to remedy, to attend to

ḫeḥt, to cut, to slice

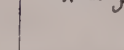
ḫeḥu, to follow

ḫeḥu, an end, a conclusion, a term,

ḫi, ḫeḳ

to reach a period

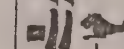
ḫeḥu, a region, the extreme limit of a country


ḫi, to fly

ḫiḥ, a gust, wind

ḫi, to fly

ḫiiru, a bandage, mummy swathe


ḫi, the, this

ḫehenti, the white crown of U.E.

ḫeḳa, to extend

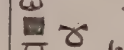
ḫeḳa, a gap

ḫeḳ, a sacerdotal title

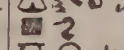
ḫeḳ, to extend

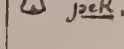
ḫeḳ, portion, piece, number

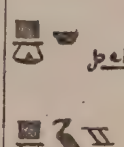
ḫeḳ, a kind of linen


ḫeḳa, flax, linen, byssus

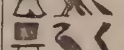
ḫeḳa, a gap

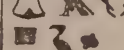

ḫeḳ, a portion, piece, number, a subdivision of Ethiopian money, $\frac{1}{128}$ of a Ten, or grammes 0.7106


ḫeḳ, a honey measure or a 7 grammes weight


ḫeḳa — the land, all divisions of land, meadows, fields &c

ḫeḳa, to extend


ḫeḳa, to participate


ḫeḳa, a gap, a hole

ḫeḳa, to bathe, moisten, to heal, spittle

ḫeḳau, to divide

ḫeḳ, a gap

ḫeḳ, "

ḫeḳ ?

Ṯsek, Ṯsew, Ṯsef

Ṯsek, Ṯsew, Ṯsef

Ṯseka, a gap

Ṯseka, clear, sagacious, perspicaceous

Ṯsekhu, a gap

Ṯsekar, a locality in the infernal region

Ṯseker, a plant, an element of the Kyphi

" " " " "

Ṯsek, a kind of tunic, linen

Ṯseku, shape

Ṯseku, a gap

Ṯsen, the, this

Ṯsena, turned over, reversed, capsized; Ṯsena Xerut, to reverse the word, to falsify what has been said, to lie

Ṯsenṯsu, to bleed

Ṯ'nu, the canal, the water

Ṯsenu, the back, the spine

Ṯsennu, a flower, ratsbane

Ṯsennu, a rat

Ṯsen Ṯsen, to hang up linen to dry

Ṯsew, the, this; Ṯ'neter ḥuat, planet Venus

Ṯsef, a medicinal plant

Ṯsef, to breed, bring forth, accoucher

Ṯsua, def. article masc: the, this

Ṯsefa, a consecrated cake or bread

Ṯsefai, part of a door

Ṯsefau, a consecrated cake

Ṯsefṯ, " "

" " "

Ṯsefṯext, a lioness; Ṯsefṯext, to fly

Ṯser, to see, to explain

Ṯser, to appear

Ṯser, Ṯses

Ṯser, to show, to appear

or Ṯser, a consecrated cake

Ṯser, to shew, to appear

Ṯsera, sight

" "

Ṯsera, plans, view, order

Ṯsera to see, to shew

Ṯsera, the Gods of space

Ṯseri, a strip, to wrap

Ṯsert, void

Ṯserw, to see, to disappear

Ṯsert hebs, the festival of the 26th day of the month

Ṯserushy, to break

" " "

Ṯser, to see, to appear

Ṯser, to surround

Ṯses, to bake, to cook

Ṯsest, the back, the spine

Ṯses ḫer, the counsellor

Ṯsesh, to stretch, to extend

Ṯses, to cook, bake, boil, to bake bread

Ṯsees, a bread offering

Ṯses, cake, biscuit

Ṯses, a paint box, or an inkstand

Ṯsesef set shait u, a cooker of meats, a cook

Ṯseshu, a bile, to bile, to sting

" " " "

" " " "

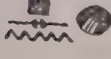
" " " "

" " " "

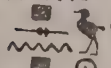
Ṯses, scribes water bottle;

Ḫes

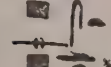
Ḫesesḳ, a log

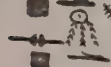

or Ḫesesḳ, a consecrated cake with the imprint of the priest's fingers on it

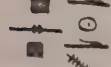
Ḫeseṉ, bread

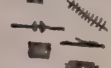

Ḫeseṉṉu, consecrated cake

Ḫesṯ, to gleam, sunset, 9, nine

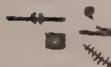

Ḫesṯ, to shine Sunset


Ḫesṯ, " "

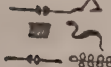

Ḫesṯ, to culminate, to reach mid heaven

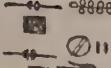

Ḫesṯ, a back, a spine

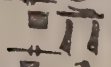
Ḫesṯ, " "

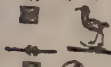

" " "

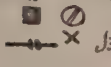
" " "

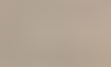

Ḫesṯ, to stretch


Ḫesṯ, the back


Ḫesex, halves

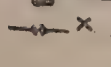

Ḫestiu, defenders, upholders

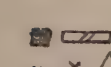

Ḫesenṯ u, followers


Ḫesex, to cut in two, to separate in two

parts; Ḫesex ḥaṯi a,

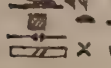
to cleave in two

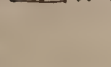

Ḫeseseḳ, to push, to stretch, to extend over, to lie on


Ḫesesḳ, to push, to stretch

Ḫeseseḳ, a kind of ornament

Ḫestiu, defenders, followers


Ḫeseḳḥtiu, the halves,

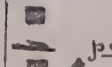

am Ḫeseḳḥtiu, amid, or in, the halves, i.e. in the middle

Ḫeseḳḥtiu the two halves

Ḫeseḳḥṯ, portion, divide, division, property of; Peḳḥtar, name of

Ḫeṯ

Horus.


Ḫeṯ, a bow, a sceptre

Ḫeṯ, the foot

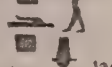
Ḫeṯ, to move the foot, to run, to fly:

Ḫeṯ indicates movement generally;

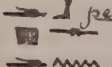
sha em ui a er Ḫeṯ en ḥaṯi a, I go according to the movement of my heart, i.e. I go at my pleasure

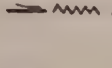
Ḫeṯ, to extend, enlarge, movement deploy, open, spread

" " " " " " "


" " " " " " "

Ḫeṯ, a sceptre

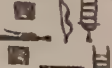

Ḫeṯeṯ, to abandon, to quit a place

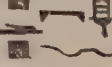

Ḫeṯeṯ en menṯ a box for carrying goods about in

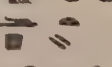
Ḫeṯeṯṯ u, the limits of the earth, the sea shore, the water's edge

Ḫeṯeṯ, a foot

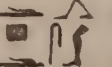
Ḫeṯ, a bow

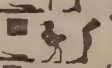

Ḫeṯ, a bow case


" "

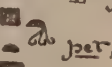

Ḫeṯeṯ, a bow

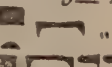
Ḫeṯi, "


Ḫeṯ, to stretch, to bend


Ḫeṯs, a claw, to claw

Ḫeṯṯu, the knee


Ḫeṯṯu, geese; Ḫeṯeḳ, to extend


Ḫeṯ, heaven

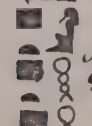
" "

Ḫeṯi, the two heavens, of Upper and Lower Egypt

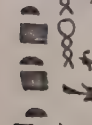
ḥpt

ḥpt, a manger, a crib

ḥpt, to open, to enlarge, to extend


ḥpt, a god

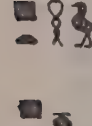
ḥpt ḥr ḫ, open the mouth


ḥpt-ḥ, " " "

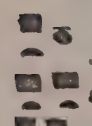
ḥpt, " " "

ḥpt, " " "

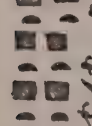
ḥpt ḥr, to open, to enlarge, to chisel, to carve, as a sculptor


ḥpteẉ, belonging to

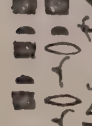
ḥpt-ḥpt, to trample, crush, slaim


ḥpt-ḥpt, to throw to the ground, crush

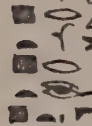
ḥpt-ḥpt, strike, trample, to rout


ḥpteṉ, to explain

ḥpteṉ, to explain, show, notify, examine


ḥpteṉ, to look, to see,

ḥpteṉ, can, basket or hamper of dried fruit


ḥpteṉ } look at, perceive, discover, attentive, care, examine, distinguish

ḥpteṉṯ, a slip of papyrus, a cord, thread

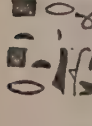
ḥpteṉṯa, who is it? what is it? what does it mean? how is it?

ḥpteṉṯa, to ask by a look, to implore

ḥpteṉṯa, time

ḥpt-ḥpt, to clash to the ground, to slam, to crush,

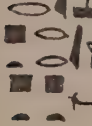
ḥpteẋ, to fly, to soar


ḥpteṯ, ready

ḥpteṯ, to invade

ḥpeṯṯ, a scorpion

ḥpeṯṯ, an offering


ḥpu, is, it is; bu ḥpu, not to-

ḥpuḳa to sack, to ravage

ḥw, ḥẋ

ḥnni, this, the; masc. def. article; an old form is ; ḥemṯ nefer ḥnni, this handsome woman

ḥnni, to fly

ḥnuḳa, a gap, a hole

ḥnuḳa, ripe fruit

ḥnuḳu, a piece of wood

ḥnuṯsha, to break

ḥpeṯera, to shew, to explain

ḥnuḳa, to divide

ḥnuḳa, a log, a plank

ḥnus (an inkstand, or inkstand; id:

ḥnuḳa, a locality in the infernal region

ḥnu, it is, is

ḥnni, the, this

ḥnuṯ, the divine assembly of the Gods

ḥẋ, a bit of the offering bread

ḥẋṯ, a lioness; the broken ring lends the idea of partition, pieces, tearing, tearing to bits

ḥẋṯ, a lioness

ḥẋṯa, food

ḥẋa ?

ḥẋṯ, a lioness

ḥehar em iu, a dyke, a wall built to prevent the encroachment of water

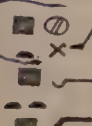
ḥẋṯ, a lioness

" "

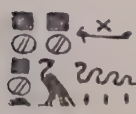
ḥẋ, "

ḥẋeṯ, "

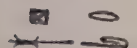
ḥẋeṯ, to be overcome, to fall prostrate


ḥẋeṯ, " " " " "

ḫeḳ, ḫesh, ḫeh


ḫeḳ ḫeḳ, to hide, to lie low

ḫeḳṯa, the serpents which contract and expand, the constrictors


ḫeḳar, the fundamental meaning is that of surrounding, encompassing: to cure, to remedy, to attend to

ḫeḳeḳ, grains, pellets

ḫeḳḳa, divisions, separate

ḫeḳḳa, divisions

ḫeḳḳaṯ, a piece of wood

ḫeḳḳaṯ, a lioness

ḫesh, to stretch, to extend

ḫesh, " "

ḫesh, " "

ḫesh, a statue

ḫesh, a flower or fruit

ḫesh, to stretch, to extend

ḫesh, water

ḫesh, to separate to divide in two parts

" " " " "

" " " " "

ḫesh, to spread the wings, to protect

" " " "

ḫesh, to divide, to partake

ḫeshmu, discord, division

ḫeh, glory, valiant, brave

ḫehti aa, most valiant, most noble

ḫehti, to prevent, to retain

ḫehti, glory, mighty

ḫehti, glory, power, dominion

ḫeḥt, glory mighty

ḫehti, glory

" "

ḥa

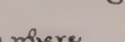
ḥa, the; in the later dynasties it stood for sixty, 60

ḥa, the city, a locality

ḥa neb, every where

ḥaḥu, ḥaḥyrus

ḥai, to fly,

ḥa, the this; 
ḥa bun herus, the evil faced (people).

ḥa, to fly

ḥai, to fly

ḥaa, (the 3) my, sing: masc:

ḥaa, " my. sing. fem:

ḥaa, my, sing: masc: (a god speaking)

ḥaa, my, sing: fem: (a goddess, speaking)

ḥai a, my, Poss: pro: masc: sing:

ḥaik, thy, " " " "

ḥa nu, our, common gende

ḥait, thy, " " fem:

ḥalen, your " " masc:

" " " " " "

ḥat, thy, fem sing: verb to be, (rarely used)

ḥak, thine, masc: sing:

ḥaiu, their, common gender

ḥaisen, their, " "

" " " "

" ḥa enti, that which is, where

ḥat, a concealed cake

ḥasu, her, poss: pro:

" " " "

ḥais, " " "

ḥatu, part: ḥast of ḥa, being

ḥatu, divine essence

ḥasen, their, com: gender

ḫi, ḥef, ḫaut

ḫi, my, masc: sing:

ḫi, my, (a god speaking)

ḫi, my, fem: sing:

ḫi, my, (a goddess speaking)

ḫi, to fly, a bird, volatile

ḫik, thy, thine, masc: sing

ḫit, thy, thine, fem: sing:

ḫif, his, sing:

ḫis, her, sing:

ḫis, her, sing:

ḫisenn, their

" " common gender

" " " " "

ḥ'anx, "The Life", a designation of Pharoah.

ḫa sep unn, something wanting

ḫa sep, the time when, when, while

ḫ'an, that is, that is certain, that is so, it is, the fact is that-

ḫiu u, their

ḫ'ḥat, bread

" "

ḫ'ḥat, a kind of food

ḫ'ḥa, to divide

ḥef, breath, a puff

ḫaut, company, assembly

ḫaut, assembly of the Gods

ḫaut, company, assembly

ḫaut, food

ḫauti, company, assembly

" " "

ḫaut, time, to exist

ḫaut, the synod of Gods

ḫw, which, which is

ḫw

ḫ'rutaru, iron

ḫ'urw, a kind of wine

ḫaut, the synod of Gods

ḫaut, foods

ḫaxer, the necropolis

ḫ' sheshti, crowns

ḫaut, assembly, synod of Gods

ḫaut neteru " " " "

ḫauti " " " " "

ḫaut, company, assembly, circle of

ḥeḥ, the rump

ḥeḥ, arrive, until, attain, reach, end, conclusion; ḥeḥ er ḥat ḥeker ur, (arrive in mouth front hunger great), starvation staring in the face

ḥeḥ, function

ḥeḥ, a lake

ḥeḥti ḥeb, the feast of the 22nd day of the month

ḥeḥti, glory, valor

" " "

" " "

ḫuka or ḥuka, magic

ḫehui en menfiu, arear guards

ḫehut menesh, stern of a vessel

ḫuu t, confines, frontier

ḫuu, region, extreme limit of country

ḫuu, a lake

ḫui, a marsh

ḫuu, a marsh

ḫeḥn, a lake, a dependent of the temple

" " " " "

per

per, a house a palace

per kait, book house, bibliothique

" " " " "

" " " " "

per aa, the great house, a title of the Pharoah, similar to that of the 'Sublime Porte'

per, a house, a door, a trimester

per anx, hall of the High Priest

peri, to come forth, to go out to appear

" to emanate

per, to emanate, flow forth, to pour out

per, grain

per, "

per hut, treasure house for silver

peri huti, double treasury, Royal treasury of silver

per hemtu, the harem

per hut, silver treasury

peri aa ast Pthah en hat. the oldest temple of Pthah in Memphis

peri hemtu, harem

per hati em mer hrw, daily peace, tranquility, well being

peri t, a granary, a house, an abode

pirn, a girdle, a band, a bandage

" " " "

peri em hrw, out of the day (into the night), an euphuism of death, also the souls' daily leaving the body in the tomb and accompaning the sun, in its barge, on its daily course through the heavens; the going out during daylight

peri em ru issued from - out of the mouth

per

per em us, a pyramid

per nu per, an interior appartiment

per nubt, a treasury for gold

per nu, a pail, water

per Kar, an arsenal

per nefer, the principal room of a tomb, where the sarcophagus was placed

perer, food

per neser, house of flame, an euphuism for sunrise or the eastern horizon

perri t, to appear, to come forth

" " " "

pes, a cake

hebs per semt, feast of the 4th day of the month

per sen, a kind of cake, cooked food

per shenes, a harem

per suten, the Kings' house, palace

per t, winter, to appear, to proceed

per t, winter

per t, proceed, emanate

per t, grain

" "

peri hebs suht, the feast of the coming of the star Sothis

per t aa, feast of the 'great coming of Osiris'

hebs peri t Xnumph, feast of the coming of Khem

per ur, the great house, the Western horizon

per netu, the eternal house, the tomb, a patternal inheritance

per, paw, pet

per ḥuat, a part of the temple set aside for the purification of Pharoah, the chapel of Pharoah's consecration

perex, a mattress

perxi, a flower

pertxeru, a sacred ceremony performed, with offerings, in honor of the deade.

" " "

" " "

" " "

" " "

" " "

peresh, a small tree, a shrub

per shenti, a harem

" " " "

paut, an eyeball, the divine synod, the assembly of Gods, number nine, 9

hebs paut, the festival of the 9th day of the month

paut, the assembly of Gods, nine, 9

paut, nine, 9

hebs en paut, the feast of the new moon

paut neteru, the divine synod

" " " " "

peti, a bow

peti a color

petu, auxiliaries

peti, a color

petu, foreigners

petu; 3, 9 or 15 bows represent foreigners

pet, r

pet, the sky, the heavens

her, over, above, chief, on, upon

her exaitu chief of scribes

her ahat, master or foreman of a workshop

her ariu hesbet, superintendent of the makers of (artificial) lapis lazuli

hermenoh, chief of vessels

peset, to shine, a ray

pet, the sky, the heavens; pet, sky;

heri, above, over, chief of-

her kab, the lord of the corner; name of four genii, represented at the four corners of a sarcophagus, under form of mummied hawks-

pet, an incense measure

R

ru, the mouth; is a preposition, to, for, by, towards, of, than

rw, a mouth, an opening, a portal, a word, discourse; It marks the divisions, or chapters of a book. it also composes fractions, as III, 1/3, 1/10. tiat her xet er, (gave on sail towards) began to sail towards

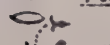
ru, a duck; the fraction 2/3

ru, a door

ruper a temple

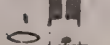
ru, ra, rf

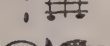
ru, the mouth

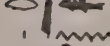

ru, a drop of blood, a variant of shi

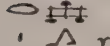
ru, a door

rui, a pair of doors

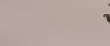

ru, a path, a gate, an entrance

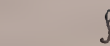

ru an, the mouth or gorge of a valley

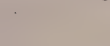

ru, proximity, neighborhood

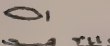

ra, to do, to make, a work, to work, to place; em ra, truly, in fact in reality; ra am her, (to place before one) to order one to - ra hati, to work heartily

rua, state condition; rar hati, lit. the


ru an, gorge of a valley


ru anti mouth or gorge of valley

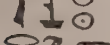

ruant mouth or gorge of a valley


ra, time

raa, swift going, come near

rauti, swift

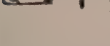
ra, the sun; em ra, during the day; em ra ḥat, in construction

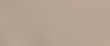

ra, a formula

ra ḫua, I am

ra, swift

rau, a pencil, a reed


rauar, a kind of food


ref, indeed, forsooth; often occurs in a, seemingly, useless manner.

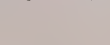
ref ref, a crumb of bread

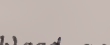
ref ref, a moth, a worm, a snake

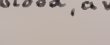
ref ḫuti, a white worm a scorpion

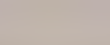
iref, archaic form of 2nd person sing:

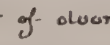
rh, rḳ,


rehen, adversary

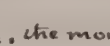

rehen, a shrine, the lid of a box

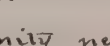

rehunt, the province of Fayoum

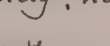

ruḫi, lion gods, twins

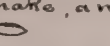

" " " "

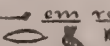
ruḫau, the evening


ruḫab, vapor, fire, steam, smoke

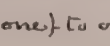

reḫan, to do something:

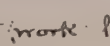

reḫan ekṯu em ḳeḳṯieḳ ḳeḳef, you have done it of your power itself (your own power)

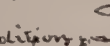

reḫen, an offering


ru su, a commonly used fruit

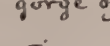
reṯeḥ, to subjugate, to force into submission

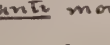

reḥ reḥ, a wish, "souhait"


ruḫan, a treasury


ri, mud, dust, powder

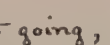
rui, mud

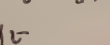

rui, a door


ruit, a vestibule

ari, to enumerate

rii, powder, paint, color

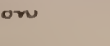

reḳ, time, epoch

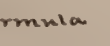

" " "

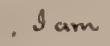
" " "

" " "

reḳa, to repulse, to turn away


reḳaiu, profane, culpable


reḳeḥ, fire, heat, flame


reḳḥu, " " " "

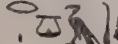
reḳeḥ, a name of the jackall

rekᵢ, a scorner

rukeh, a brazier

rukeh, a brazier, fire, flame

rukᵢ, culpable


rukaṯ, floor, ceiling

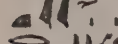
rnka, to cease, to cause to cease, peperation

rekau,ᵧ, culpable, guilty, rebel

rekau, to decline, to avert, to de-
fleet

rekᵢ, an enemy, a rebel, a culpable

rekiu, the enemy, rebels, the culpable


rekᵢ, enemy, rebel, culpable

rekᵢ, to fail, rebel

rem, a fish

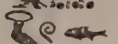
" "

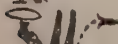
er maṯer, who then?

er ma, near

remᵢ, to weep

remᵢ, to weep, tears

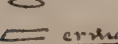

remiu, a fish


remᵢᵧ, to weep, tears

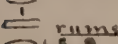
remem "

rem rem, a fish

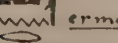
remṯᵢ, to weep

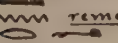

er ma, near, beside

er ma, then, when, near, with, beside


rumᵩ, to rise, to get up

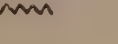
remu, mankind


ermen, until, since, upto-


remen, to touch, to carry off, to raise

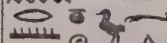
remeni, the arms

remenṯ, an arm


remen, a measure of five palms length

or of the length of 20 palms breadth

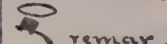
erment, a cow

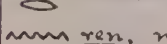

ermennw, an arm

emennw, branches

remu, people, mankind, nations

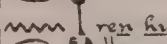
rema an agrarian measure, one schaene


remax, a rhinoceros

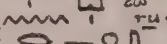

ren, name, cattle

ren, a name, to name, a list

" " "

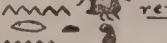

ren hiuṯ, an antelope

reni, cattle


ruenka, puberty

ren kaheo. an antelope or gazelle.

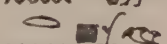
renen, cattle, to be young

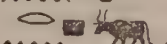

renew, to dandle, a nursling, a babe

renen ṯ, a young girl

rennu, to be young

renefo, to grow, to renew

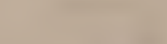

" " "


renefo, a flower

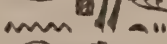
renefo, young

renfoa, to grow, to renew;

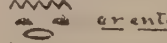
renfiṯ a, el grow young,
to rejuvenate

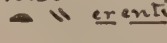

renfi fruit

renfiliu, young, fresh vegetables


renfiu young

er enti, inasmuch as, when, whether


er enti, in a writing, marks a change of
subject; it means litterally it is so that; it
may be left out in translating


refo, to grow, to flourish, to blossom

rsp

rsp.t, lord, prince, heir apparent

rsp.t asw, ancestral Prince, Royal heir apparent

rsp.t, a lord, illustrious

, rsp.at, a noble lady, the constellation of Virgo

rsp.ati, a noble lady

rsp.at, ?

rsp.i, wine

rsp.i t, a noble lady

rsp.i lu, fresh vegetables

rsp.it, a statue

ru spek.u, a mythological locality, probably the mouth of the tomb

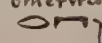
rsp.t, a statue

" "

rspenen, rhubarb

rspeti, a noble lady

ru.spu, or, nor (father nor mother), neither, no more than -, otherwise

rsp.et, a depositary; 
ru.spelu barbarians

ru.sper, a vestibule

ru.sper, a temple

" " " "

ta ru.u aun, a quarry

ru.sper hunt, Labarynth; (house of the mouth of the neck of the reservoir, at Moeris, temple of Rusiunt).

Ru.sper nehunt, " " " "

rer, a circuit, to go round, to haunt, to frequent, to respond to an accusation, is the same as
an to return, to refuse

" " " " " " " "

rr, rs

rer, a nursling

rer, a man

rer, to dandle, to nurse

rer, ingredients

rer, a snake

rerw, in the midst of, every where

rera, a sow

rera, "

rera t "

er ra, as far as, unto, until

rer heremer, to direct towards

rerek, a snake

rermw, a fish

rerw, a drop, a part

reri, forthwith, at once, at the required time

rer t, a receipt

rer t, a hippopotamus

ruu, all, every

erla, to give

rerlu, to whirl

reru, steps

reru, a pool

rerw, children

ru.ru, a pool

resu, to watch, to devote time to, to spend time

res, to watch

res sta, the mouth of the tomb

res, the South

reo, to raise up, to watch

resu, to watch

res, the south.

res, absolutely, entirely

res, the South

res, the south country

ru sti, the entrance to the lower world, the entrance to the tomb

res, the South

ret, a leg

reti, the legs

" " ;

ret, plant, grow, germ

ret, to fertilise, to fecondate, generator, to germinate, to grow

ret, abound, to tie, attached to

ret, to engrave, to carve, sculpture; retu en ef, sculptured or engraved by him

retu, to tie, a tie, a bond, attached to a farmer, an overseer, a superintendent

ret, a foot stool

ret, sandstone

ret, foot stool

ret, to plant, to grow, to shoot, to sow seed, to grow vegetable matter

retu, to plant, to grow

er teb, to ask

" , "

er tehb, to beseech

rethe, to quarry

retu, vigorous, to urge, prosper

reti, to beseech

er tut, to say, precedes an explanation

retu, bandages

ret, a man

ret u , mankind, men

retu semt u , laboring people, workmen

retu kat u , workmen

retu, a fish

ruti , to work

retatiu , poison, urine, ichor

retau w , thieves

reter , entire

reta , to cause to, to make, to allow, to have made, to augment

ru r , the mouth

reteh, to subjugate, to force into submission

" " " " " " " " "

reti , a gate

er ter, entire; er ter sej, continually

er ter ef , "

retek , a mythologic serpent

rrtu , a jug

retu , seed

er tat, to have made, to allow to be made, to permit, to allow; er tut, to give

retuu , urine, ichor

ru , a spike

ruad, to separate, to put aside, to lay apart, to carry away

ruaa, to rush, to go swiftly, to chase

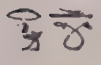
t ruha , the evening, nightfall

er uha , a quarry

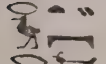
ruu u , doors or lintels

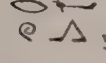
rut, to engrave, harder

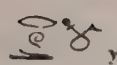
rut, rex


rut, to make green, to render fresh, flourishing, to restore, to germinate, to grow, to vegetate vigorously, vigorous

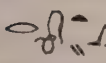
rut, door, pylon, king's palace, Pharoah

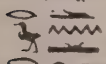

ruti " " " " "

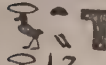

ru, to separate, to put aside or apart, to carry away


rut, to render green, fresh, flourishing to restore, to germinate, to grow, to vegetate vigorously, vigorous, fecundate

rut, to put out of doors, to put outside to carry away, that which is outside)


ruati, " " " " " " "

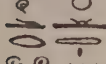

rutēn, to attack

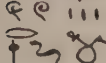

ruti, to put outside, that which is out of door

rutu, to go out,

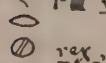
rusha, care, anxious, anxiety

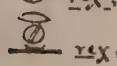
set rusha, a paddock, pasturage

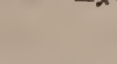

rut, to engrave


ruu, islands

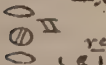
ret, to engrave


ru, a pen, a reed)


rex, to know, a relative, to wash, to purify


rex, to know, to reckon, to calculate, account, to be made aware of, to enter into knowledge of a matter, to know of a chamber i.e. to enter a chamber, pour. or

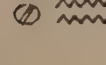
rex, an architect


rex, ?

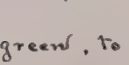
rexu, people of a district

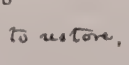
rex, to know a woman, cohabit

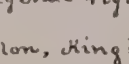
rex, to wash

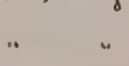

rex a washer

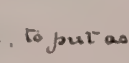
rex, resh


rexiu, intelligent beings

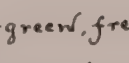

rexiu, pure spirits, wise, enlightened beings

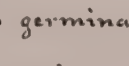

rexi, pure, wise

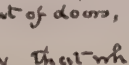

rexiuu, " "

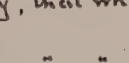

rexi xet, (Know things) a Magus,

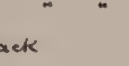
rexes, to immolate

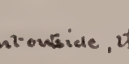

rexes, to engrave, to embellish

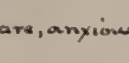

rexet, to enumerate, list, number, recital, enumeration

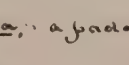

rexet, an architrave

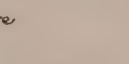

rexet, a laundress

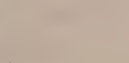

rex xet w, (Know things) a wise man, a Magus.

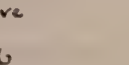

rexiu, mankind, intelligent beings, wise men

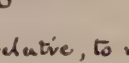

ru, a pool

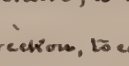

resh, joy, to rejoice

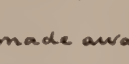

reoh, joy to rejoice

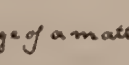

resha, " " "

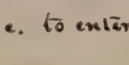

ru shenti, a tank

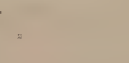

resh huaw, opprobrium

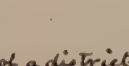

resh resh t joy, to rejoice

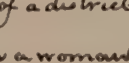

resh w, feathers, joy

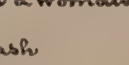

reshti w, people of the South


reshuti, joy


ruuat, the side


ruaai, proximity, vicinity

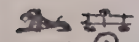

ruawe, the bank of a river


ruauw, the side

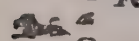
rat, a foolstool, stairs, a boat

rabu, a lioness

ru, a treasury, a storehouse


ruk, time, epoch

rukai, to soften, to melt


ruk, time, epoch

ruxt, to wash, full

rumai, expresses a relationship, a son in law, a bastard

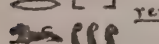
rerer, a pylon, a tower

rerit, a storehouse, a depot, a magazine, a treasury

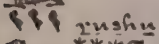
rererit, " " " " " "

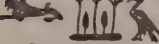
rerīt, an ark, a shrine, a niche

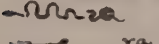
rert, a storehouse, cells


rushu (usx ma) temples

rushu, to rejoice, joy, temples

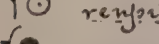

rushauw, the summit


ra, the sun, ra, the sun, time


rusha, evening, nightfall

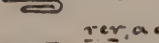
renpit, the year

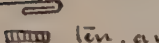
renpit, the year, a season

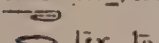

renpitū ashu, hundreds thousands years

rer, a circle, a crowds, to go rounds

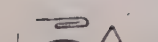
lēn, a weight equal to 90 grammes, heavy

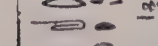

lēr, to dart forwards, to precipitate oneself

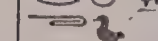

lēr, midday


lēr, to go around, haunt, penetrate go towards, open;
lēr sen mena t, to approach them to the breast

ulēn, a money, purchase of bronze, weighing about 90 grammes; there was a golden lēn and a silver lēn, the latter was worth about ₰ 3.80


rer, to go around, to circulate


rer, a circle


reru, to traverse

lēn, an offering

ret, raed

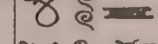
nelū, a mason

rulūu, peasants, cultivators of grain and orchards, agriculturalist

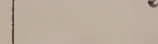
rulū, comptroller, verifier, agriculturist

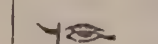
rulūu, inspector of buildings

rutuu, ruin


rutuu, an agriculturist, an inspector, an overseer, a comptroller, a servant

rulū em xer sperw, engravers of the tombs, overseers of the tombs.

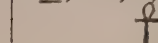

res, to watch, vigilance;
er en res ast, to watch over; a vigil


retiu reshu, Southern people

se, she it, her; a prefix of verbs; a causative, as, anx, to live, s'anx, to cause to live, to vivify, to nourish

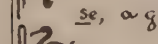
se, a goose

" " "

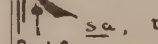

sa, to prepare

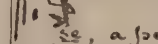
se, a person, any one

saf, the 10th day of the month


saat, to beat, to paralyse

saaw w glorification


sab, profane, wicked


sab, a jackall

sah, a mummy

sa, sab

saw, to be killed, overthrown, felled

saw, to charm, a charm

sannw, to pay, payment

saw, to speed, to hasten

sap, to save, to heal

saw, to slaughter, to immerge

saw, preparation

saw, clouds, obscurity

saw, to indulge, to lend oneself to -

sam on se mer-rit, they lent themselves willingly to-

sasp, to count, to reckon, evidence, proof

sasp, make, create, form

sasti, " " "

" " " "

sasti, an account, a register

sas, to weigh

sas, six, 6

sat, ear ache,

satew, to conduct

satti, to beat, to paralyse

salen, to direct, to order

sati, the legs

sati, to cross over, to pass by

sau, to drink

" "

sauu, "

saur, "

" "

" "

sahat, to condemn, to charm

s'ab, to give light, a counsellor

sab, a jackal a counsellor

sab,

sab, a counsellor, an eunuch

sab, a jackal

" "

sabi "

sabi, a kid, a lamb, a wether

sabi, a wolf, a jackall

sab merw, a functionary

sabu, to circumcise

sabu, an ox

sabu, mockery

sabiu, jackals

sabex, to move

samer, a friend, a companion, a priest, a Thurifer, sab uat, an intimate friend

smer, " " " " " " "

" " " " " " "

sa, a mummy

sa, to conduct, to understand

sa, to set up

sab, ornament of attire

sah, a mummy

sahu, the sun before rising from Amenti is represented by the figure

sama, lame, broken in, domesticated

s'ak, to make enter, to direct

sam, ferule, border

sahu, a mummy

sak, to hold in equilibrium

sar, to finish

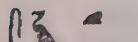
sar, to conduct

sari, a ewer

sah, to perambulate

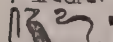
sahu "

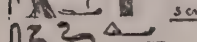
sak, saw, saw


sak, to draw

samis, to burn, to devastate

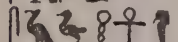
sam, to prevail, to cause to be taken, to seize


sata, ?


sat, a festival

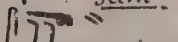
" "

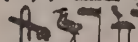
sati, annihilate, wound

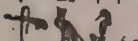

sahw, a mummy

saku, to contract, unite, assemble, approach oh

sam, the human body


samhui, to bear witness, to give evidence


samn, a standard


saw, a likeness, a resemblance, a form, an image an effigy, similitude

samti, to listen, to overhear, to spy, to question, to examine orally, to make an inquest, to verify, to judge, to examine by torture

samt samt, deaf

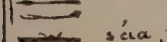
sam, to come in sight, to shew, to manifest, to shew the road, to guide, to conduct, to lead, to direct, to organise, to distribute

samti, judicial proceedings generally; an investigation re. It sometimes means torture

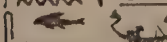
san, to get well, to charm, to preserve

s'aaa, to be superior

s'aa, to glorify, to exalt, to praise


san, clay, sealing clay

san, a sacred barge


sannu, to pay, payment

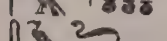
ab

sannu, to pay, payment

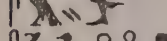
s'anx, to vivify, to cause to live, to nourish, to subsist

san, to be made, to become

sannu, mild, intelligent


sannu, a bath, bathe, fishery

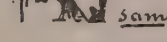
sannu, to pay, a payment, price


sanannw, compliments, caresses

sansan, to address, to speak to, to deprecate

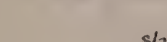
sanent, payment, price

seba, a star; seb, to drink


" ; seb, profane

seba, a door, a gate

" " "


" " "

sebai, door. "

sebai, to chastise to punish, to teach, to instruct

sebai, to laugh, to rally to joke

" " " "

s'eba, to instruct

sebai, a gate

sebaiu, to instruct, idem

sebai; a gate

seb, to pass

seb, a reptile

seb, a flute

" "

" "

seb, a wall

seba, profane, wicked

sb

seba, a sword

sebaK, small, young, vile

seba, a flute

seba t, food.

seba, profane, wicked; , variant

sebaw " " "

" " " "

sebaw, to insult

sebaw, profane wicked; var:

sbauK, a crocodile

saba, to teach, to pray, to learn

sbai, a gate, a door

sbai, a gate, a door

seba to instruct

sebaw, "

sbai, a gate, a door

sba, solace. sebek, to go along a road

gebeh, to roar

gebhu, to sob, groan, cry for help, insult

sebhu, to roar

sebeh, to roar, to squall, a goose

seb, a quantity, a basketful

sebi t, chastisement, punishment

sebi t, a flute

sebi, wicked profane

sebeK, the planet Mercury

sebKau, to exercise

seb, profane

sebeK, to subdue, to prostrate, to impregnate an egg

sebeK, a balsamic tree

" " "

sebeK, to anoint

sb

sebeK, the eye

sebeK, refresh, to refresh, refreshment

sebeK, a leg or foot, to kneel, to adore, to venerate, venerable

sebeK, a leg or foot, to go along a road

sebeK, to contract, to tighten, to unite, to approach, to assemble

sebeKa u, submers

sebKu, to subdue

sebKeo, a leg or foot

sebeK, to go along a road

seben, general name of mummy swathes

seben, a garland

seben neter renpi, new hay

sebeni, to clear

seb seb, the soles of the feet

seb seb, a belt, a girdle

sebt, the dog star, Sothis, Sirius

sebti, a wall

sebet, a gate

sebet, a wall, a rampart

sebti " " "

sebti " " "

sebti, a crown of flowers

sebw, the profane, the wicked

sebex, to adore

sebex, ?

sebex, to snare birds with a net, to overthrow an enemy

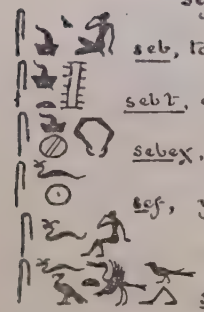
sebext, a chest

sebext, a pylon

" "

sebext, the gateway of Amenti

sef



seb, to roar, pray

sebt, a wall

sebex, to protect, to defend

sef, yesterday

sef, childhood

sefat, careless, brightness, frivolity

sfti, cedar oil; seb, cedarwood

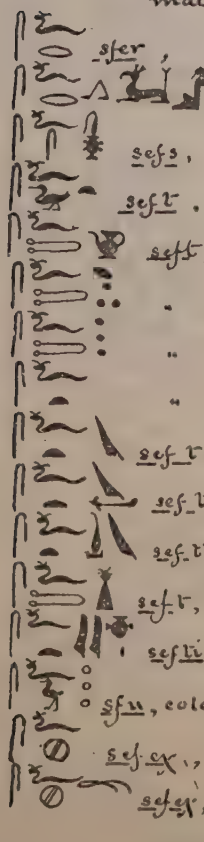
sfennw, emotions of the heart, impulse, repugnant, to aspire, sfen, to dislike, to like ver

sefnew, the past, knowing the past

sfent, detest, to detest, to hire, detestable

smsft, a butcher, (a bleeder)

sfer, a fantastic hawk headed animal



sfer, a gryffshow

" "

sefs, to melt

seft, volatile

seft, pitch, bitumen

" " "

" " "

" " "

seft, a sword

seft, to put to the sword

seftt, a swords

seft, one of the seven oils of offerings

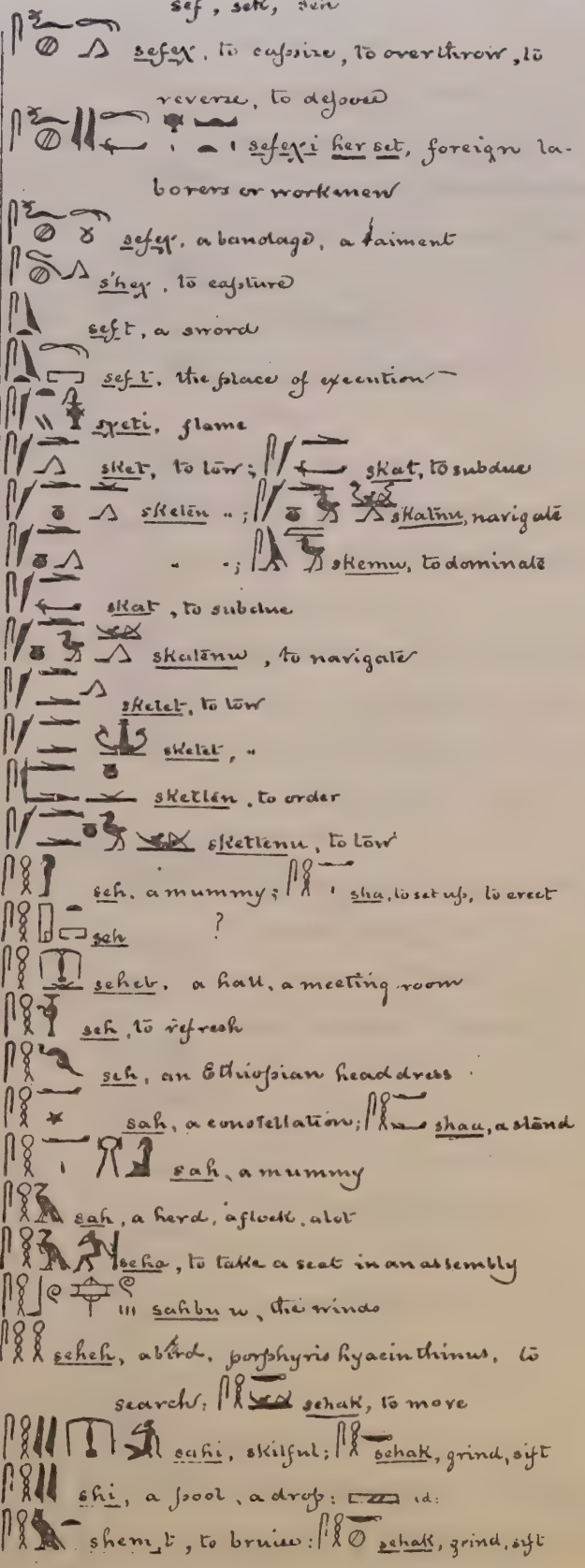
seftt, bitumen or cedar oil

sfu, colors, paints

sefex, seven, 7

sefex, to capsize, to overthrow, to reverse, to depose

sef, sek, seh



sefex, to capsize, to overthrow, to reverse, to depose

sefexi her set, foreign laborers or workmen

sefex, a bandage, a raiment

s'hex, to capture

seft, a sword

seft, the place of execution

xeti, flame

sket, to low; skat, to subdue

skelen " ; skalnw, navigate

" " ; skemw, to dominate

skat, to subdue

skalenw, to navigate

skelet, to low

skelet, "

skellen, to order

skellenu, to low

seh, a mummy; sha, to set up, to erect

seh ?

seheb, a hall, a meeting room

seh, to refresh

seh, an Ethiopian head dress

sah, a constellation; shau, a stand

sah, a mummy

sah, a herd, a flock, a lot

seha, to take a seat in an assembly

sahbu w, the winds

seheh, a bird, porphyris hyacinthinus, to search; sehak, to move

sahi, skilful; sehak, grind, sift

shi, a pool, a drop; id:

shemt, to bruise; sehak, grind, sift

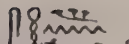
seh

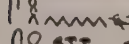
sehenu t, to strangle, to suffocate

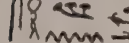
sehent, " "

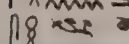
sehem, " "

sehen, to send away, to reſpulse, to arrange, to adminiſter

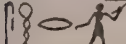
 sehew, to depoſe, to arrange, to adminiſter, the impedimenta of an army

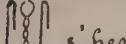
 sehenu, to bring, conduct, lead

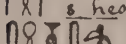
 sehent, to command, to order

 sehennu, to diſpoſe, to arrange, to adminiſter, a concesoion, a donation

sehew, a crown

 seher, to ſweep, to clean up

 s'hes, a ſinger, to charm

 " " "

s'heti, to light

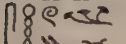
s'hui, to aſſemble, to ſout together, unite, addition

sahu, manure, coſaros

sahw, a neeſtor

sehw, to aſſemble

sehuw, "

 sehui, " "

sehui, to unite, to add, to ſout together

sehura, to ſolke, to curſe

sehur, to curſe

sha, to ſet up, to erect

sha; to erect, to raiſe from its ruins, to erect and repair,

" " " " " "

sha, to riſe

sh

 sha, to raiſe, to erect

 sha, a long mast, a greaſy maſt, a ſlipperſy pole.

s'ha, ſoricle, charm, bewitch to faſcinate, to ſtrike malefactors

" " " " " "

s'ha, to encourage

s'ha, to make fall, to force out, to extract

sha, imprecations, to ſwear

sha, to leave, to neglect

seher, to charm, to render happy

seherer, " " "

seheri, a pleaſure boat, repoſe

sha, to reveal, laybare, diſcover

sha, to order, preſcribe, to render glorious, to glorify, to cauſe to be celebrated

sehauw, to diſcover, to unveil, to reveal, to lay bare

 s'her, to ſcare, to driſve away

 seher, to extend, to prolong

 s'hera, to diſſipate, to cure diſeaſe

 sheraw, to ſcare, to driſve away

 s'het, daylight, to illuminate, to inſpect, to elucidate, to determine

 s'hut χat, an edible

 s'hut, daylight, illumine

 s'hut " "

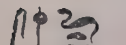
 " " "

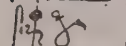
s'huti " "

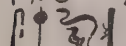
 s'hut Asairi neter, the ſentence of Oſiris giving the defunct the new life,

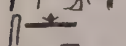
sh, si, sek

in Amenti, 'let him be enlightened'

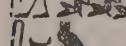

s'hut, to transmit, to bequeathe

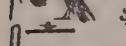

s'hut rut, to engrave


s'hut, illustrious


s'heteps, to welcome, to pacify (infra)

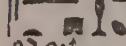
sehan, tributaries, bringers of-

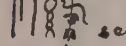

s'hem, to pound, to bruise


s'hetep, to join, to marry

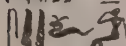
sehetep, a censer, a thuribled

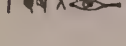
sehetep han sw, a sacerdotal function


sehmeh, the name of a sceptre


si, a child

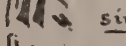
sis, "

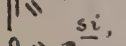

sih, craze, demented, folly, evil action, fascination


siu, a star

siui, "

si, it, she, her

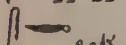

sirw, to gather

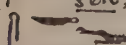

sirui, a saw

siu, a sow

sek, after, when, then

sken, to stiff, to choke, to obstruct


sekti, the cabin of a boat, an ark


sek, slope, waste

sek, to guide, conduct, move

sek, draw, carry off, destroy, carnage

sek, destroy, annihilation

sek, the end, death

sek, to carry off, destroy, carnage, draw

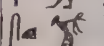
seki, battle, carnage, melee

" " " "

sekti, the barge of the rising sun

sek

sek, to lift up, to applaud, to cry out


sek, a captive

sek, a serafee, a captive, play the harp

sek, to lead captive, to lead, to draw

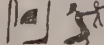
sek, to subdue

sek, to serafee, to slay upon

sek, to beat, strike, to play the harp

sek anx, a live prisoner

skeb, a captive, to subdue


sekeb, " "

sekeb, mummy, type, bind

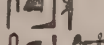
sekeb, a spondist, to refresh

sekeb, (applied to an egg)

sekeb, a leg or a foot

sekeb, to contract, to close, to unite

sekeb, a captive; skeb, an eye

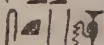

sekeb, to invoke

sekbu, a place of refreshment

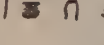
skebeb, to reflect, double

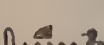
skebeb, to refresh

skenen, to render victorious

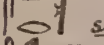

skennu, a mixture, often perfumes, used at funeral ceremonies

skennu, to multiply


sker, to destroy, to tear off


sker, to strike, to play the harp (with plectrum)

" " " " " "


" " " " "

sker, to make an offering, a libation

sak, to unite, put in order, to arrange

sak t " " " "

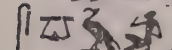
sker, clang

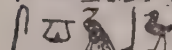
skeru, to cut in pieces

sk, sm

sḳa, to go the wrong road

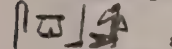
sḳa, deaf, to pretend to be deaf


sḳa ?

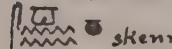

sḳabu, to lament, to groan

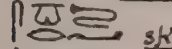
" " "

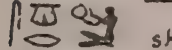
sḳaw, a tower

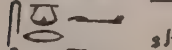

sḳab, to lament, to groan

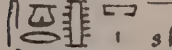
sḳabu, poor, prostrate


sḳennu, to anoint, an oil, to perfume

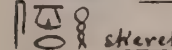

sḳer, a libation


sḳer, to play the tambourine

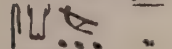

sḳer, to calm, to appease


sḳer, a citadel

sḳer, ?


sḳereh, to appease to calm, to soothe

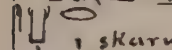
sḳa, a plough, to labor

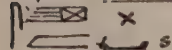

" " "

sḳa, to plough, to labor

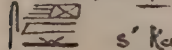
sḳa, to labor

sḳa, to plough


sḳarw, a vase

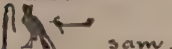

s'ḳam, to pass a time

s'ḳam, to stay, to dwell

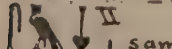

s'ḳam, to dwell, stay, remain

saṃ, a servant, a minister, a funeral priest clad in a tiger's skin, arch-

" priest " " "

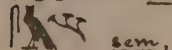

saṃ, to destroy

saṃw, mourning


saṃ, a locality, a territory

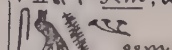
saṃu, myths, representations

sem, a clover, a fodder field

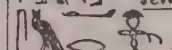

sem, clover, fodder

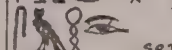
sem

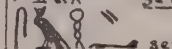
sem, a garment, a raiment

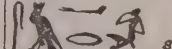

sem, meadows, pasturages

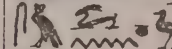
sem, a figure, a shape

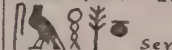

smar, to dress, to clothe

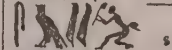

semeḥ, a complaint


semḥi, to the left, the left, the left hand.

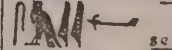

semar, to bind

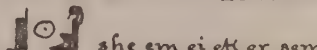

semaw, to mix, to want


semeḥ, a vine


semi, a conspirator

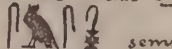
semit, an assembly, a congregation

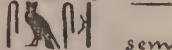

semi, It was said to the mummy—


she em ei eḳ er semi embaḳ.

Asairi, thou goest to the assembly in the presence of Osiris

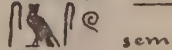
sammaw, to embellish, to ornament

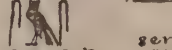

sems, to burn, to devastate


semd, to ornament, to embellish

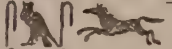
sems, an elder, preferred

sems, an elder, preferred, adopted,


semsw, a prince


sems, " "

sems, " "


sems, a horse

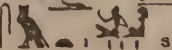
semsem "

semsemw, an eldest son

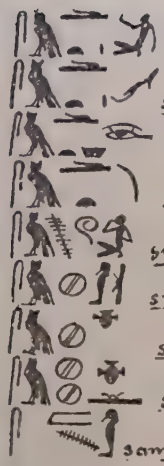
sems, adopted

sems, a field

sems, to burn


semt tu, persons consecrated to the service of a God

smn



samtut, to be devoted to-, consecrated

samtut, to rule over

smat, stibium for coloring the eyes

smat, a half-month, to paint the eyes

smu ?

smax, an image

smax, to rejoice

semxax, "

sam, a resemblance, a likeness, a similitude, effigy, image, form

sma, to be destroyed, to smite,

" " "

samt, devoted to- consecrated,

sma, to open, to cause to be opened

sma, to call, to invoke

" " "

sma, territory, locality, conspire, combine

sma, to subdue

sma, to repair

sma, to cut, to kill, to massacre

sem, locality, combine, conspire, territory

smai, the hair

smai, to smile

smami, conspirators

smamw, to kill, to massacre

smamw, destroy, strike, annihilate

smaiw, to repair

smani, to ornament, to restore, to complete a monument

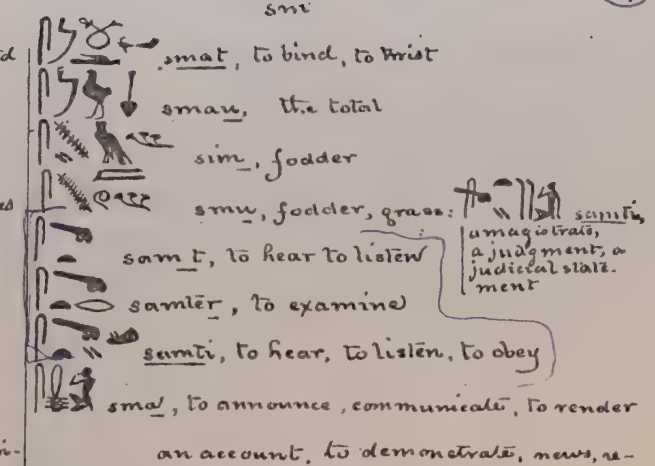
s'mam, to strike, to accuse

smemi, to smile

smaar, to kill, to massacre

smaraw, to bind, slaughter

smr



smat, to bind, to twist

smaw, the total

sim, fodder

smw, fodder, grass:

samtiu, a magistrate, a judgment, a judicial statement

samt, to hear to listen

samtr, to examine

samti, to hear, to listen, to obey

sma, to announce, communicate, to render an account, to demonstrate, news, report, accuse, discourse

sma, to order

smaw, to discourse, account, figure, paint

smaw, discourse, order, accuse

s'menkemhebs, squeeze through a cloth

smaw, to paint

smati, a workman, an artisan

semi, to announce, to communicate, to render account, to shew, to demonstrate

semi, a liquid remedy, animal gall

semi, an accomplice, a partner

semi, to discourse, to account

semi nefer paint

semit, simnel, fine wheat flour

smew, to strengthen, to constitute, to establish, to make durable, permanent, immovable, to consolidate

smen, a goose, a place, to dispense

smen, one sent to explore

sment, a place, to prepare

smen, a goose

smenfw, virtues

smenut, to confirm a title to property re

s'menx, fortunate, beneficent

sem sen

selēm, to listen, to hear

selēm, " , " "

sem, to pass, to traverse, effigy, image, likeness

sem, to traverse, an emblem, an image

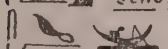
sem, to traverse, to come in sight, to manifest, to shew, to shew the road, to conduct, to guide, to direct, to organise, to distribute

semti, to listen, to hear

semu, to praise

sem, a likeness, a similitude, an effigy an image, a form, a statue

sem, " " " " " "

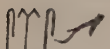

sam, a sacred barge

samu tai, a ditch, a dungeon, the abode of corruption, (the stone quarries)

smen, to prepare

sem, an altar

semui, a resemblance, a similitude, a likeness, an effigy, an image, a form


sems, a mallet

sines, to fertilise

sen, they, them, their, those who

sen, two, 2, a second, the other, a likeness, a comrade, a neighbor,

sen, to cut, to slice

snaa, to polish

snab, sound, health, heal, forgive, in good condition

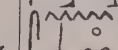
snab, fault, stain

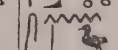
snab, a tassel of flowers, a blister

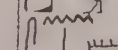
snabi, the legs.

sn.

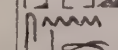
snab, a wall, to enclose to surround with a wall

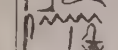

snab, a substance offered to a God


snabu, the whole, sounds

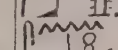

snab ?

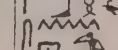
snab, a configuration


snab, a case

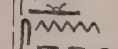

seneb, fire, a spark

senebf, a wall


, senbeh, to tie, bind, enlist, enroll


seneh, to convoke for selection, choice; to train soldiers

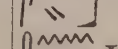
senhaf, take (shef en)


senhaf, a conjunction of light

senhas, to awaken

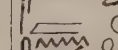
senef, last year

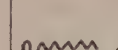
senbi, sound, whole


senoth, suck

senkeb, to be afflicted

senmef, last year, (yesterday)

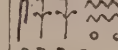

senemahiu, the humble attitude of prayer (senmehiu)

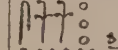

snem, prayer

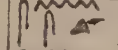
senem, sin, impurity, uncleanness

sanent, price, payment

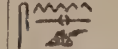
senem, a valuable stone

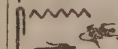

senem, a kind of perfume

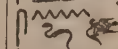

sens, to breathe


sensen, to question

sens, to breathe


sent, fear, terror, to venerate


" " " "


sentem, delightful, pleasure

snelēm, delightful, pleasure, enjoy

sent, to found, foundation

sent, terror, fear

sen teh, to measure, bind, tie

sen t, terrify, terror, fear, venerate

senti, discourse, worship

snut, a kind of wrestling

sentu, a kind of cloth or stuff

senxen, to nourish to suckle

snexex, to increase; to rejuvenate

senxeh, to nourish, to suckle

s'nefru, to render good

s'nen, an image, an effigy, a statue

" " " "

" " " "

snew, a valuable stone

snew, an image

snelēm, to be at rest, repose

snelēm, to be sealed, repose

snelēm, delightful, pleasant

sweet, agreeable,

snelēm, repose

snelēm, to be sealed

neter sti, incense

" ; sent, fear, terror

sen, a cake a kind of food

?

sen u, they, them, their

snab, sound, health; s'ab, to clean, to purify

senem, to find

sennu, an image, a statue, type

senu, " " "

sen u, they, them, their; the bony frame

seš, to leap

seš, times; seš sen, twice; seš xemt, thrice; seš met, ten times

seš, to kill

seš, flax, linen, bealen flax

sešeh, a rib

" "

" "

šeša, a country, a district

šeša, food

šser, a rib

šser to approach the side

šser, to approach

šser, the side

šser, to ask, to beg

šseh, to shut up, to chain, to make captive

šseh't, the lower rib

šsehu, to shut up, to chain, to make captive

šešs, to exhort, to console

šešs, to build, to construct

šseriw, to beg, to ask

šešt, a tool

šešt, a triangle

šešt, Sothis, star Sirius

šešt, care, sharpen, spread, prepare

šeštiu, to ornament, to embellish

šešt, a rib

šešt, a district

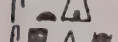
šešt, a place

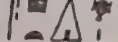
šišt, to lighten

šeštt, to prepare, to create

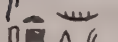
sefs

sefsṭ, to furnish, prepare, dispose, insure, pro-vide

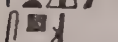

sefṭ, choice

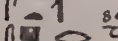

sefṭ, the lips

sefṭ, a pole, a wand

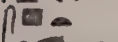

sefṭ, to furnish, prepare, dispose, insure, pro-vide

sefṭ rw, the ribs

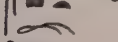

sefṭ, disposal, structure, precept


" " " "

sfu, create, prepare


sfa, to cause to fly

sfaw, " " "


ser, to drink (see infra)

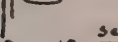
ser, a chief, superior, grandee

" " " "

serw, to dispose at pleasure

ser, to arrange, to distribute

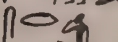
ser " "


" " "

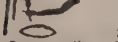
ser, a goat, a sheep

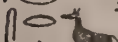
ser, to solace, to distribute

ser, a goose


" "

ser, to arrange, to distribute

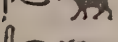

ser, a chief, a head of - -;

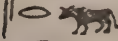

sar en sper ḥ xefecsh; governor of the workshops

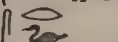
sera, a large jar, an amphora

seri, to lie down

seruiṭ, a fan, flabellum


serf, to be sealed, to be idle, at ease


serfi, to warm up, to provoke


serf, flame, burn

seru, chiefs

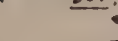
ser

seri, to rub smooth

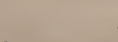
serḳ, supply, breath, breathe

serḳ to obliterate

serḳ, hole opening, to make breathe


" " " "

" " " "


" " " "

sertiu, to arrange to distribute

serer, to inscribe, trace, determine

serer, to arrange, to distribute

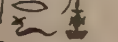
serer, to dispose

serer, to swing the doors open

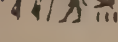
sererw, to unite

serpeṭi, a plant growing on the banks of the Nile, lotus or papyrus

sreṭ, to grow, to germinate


s'reṭa, sculpture, polish

s'reṭ, polish


sreṭ, to arrange, to distribute

sreṭi, ancle

sreṭw, to venerate

s'ru, to fabricate, to make

s'ruṭ, to dig, engrave, plant

s'ruṭ, to plant, to renew

" " "

s'ruṭu, sculpture

s'ruṭw, to engrave

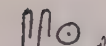
s'reḳ, that which makes known, i.e. a banner, a standard

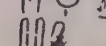
s'reḳ, a palace

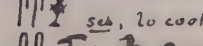
s'ruṭ, to carve, engrave

ses, to breathe

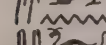
seu, six, 6

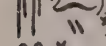

ses, time, date, day, epoch


ses, to cook, to purify, to refine, to melt

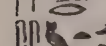

sesannu, to agitate, to torment, to punish, to destroy, to make suffer, to divide, to cut, to distract

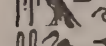
" " " " " " " "


sesfu, to melt, liquify, dissolve

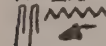

semer, a male

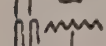
sesemt, a mare

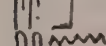

sesmut, a mare


sesen, to breathe

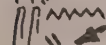
s'snab, to give health, strength

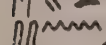

sesen, to breathe

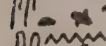

sesenu, to breathe, to sigh

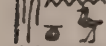

sesent, " "

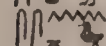
sesennu, eight, 8

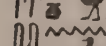

neteru sesennu, the eight Gods

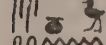

sesennu, to fight, to torment


sesen t, to breathe

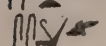

sesen, "


ses neterem, Cedar wood


sesfu, to prepare


seser, to breathe

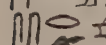
s'sahu, to journey

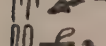

seshen, to breathe,

sest, a mare

sesu, a division of time, daily

sesu, the Egyptian week of ten days

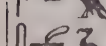

sesau, to guard

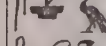

sesat, to sail, to transgress

s'ak, to make enter, to direct

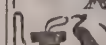
s'sa, able, skilful, a name given to Thoth, tatu

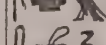
s'saa, able, skilful


s'aatt, grief

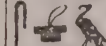

s'sa, to be satiated, hunger appeased

" " " "

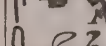

sesah, a neighbour


s'sah, to perambulate, to go along.

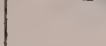
s'sahi, to go along

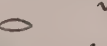

s'sai, to weaken, feeble, of little value, impure, soiled

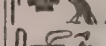
s'sart, to arrange

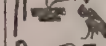

s'sart, fail, transgress

sesart, a wall


sesart, wisdom, science

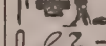
sesa, to lead;  to push

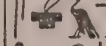

sah, Orion


sakq, to collect together, to arrange, to put in order

sesafu, to prepare

sesat, a wall

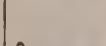

sesau, a wall, a partition


seser to arrange, to distribute

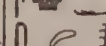
set, the refuse the rejected

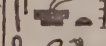
set, a tail

" "


" "

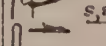
set, to terrify


set, to draw


set, destroy

set, to push, to draw, to overthrow

set hebs, to celebrate, a celebration, celebration of the thirty year festival


seb, to direct a panegeric

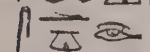
sta, to break down

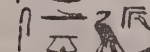
set

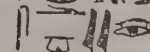
sṯebeḥ, a wound, disaster, misfortune

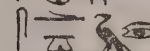
sṯeb, difficulty, deficiency

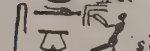
sṯeṣ, to erect, to build


sṯeḳ, to escape notice of


sṯeḳa, to be concealed, to lie hidden


sṯeḳi, to lie hidden, escape notice

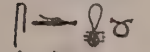

sṯeḳa, to see

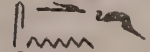

sṯeḳ, to lie concealed, to be under cover

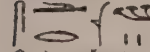
sḏem, to hear, to listen

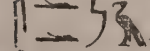
sdem, stibium, antimony

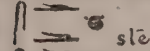
" " "


sṯem, a kind of cloth

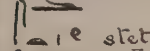

ḏen, an Ethiopian headdress (royal)


ḏeru, plants


sṯet ma, to make adhere


sṯet, to row

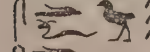
sṯet, to grasp


sṯet "

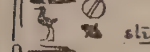
sṯet, a tail, below

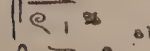
sṯeb, a sacred vestment

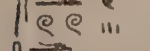
sṯebḥu t, activity

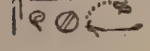

sṯefu, to purify, to improve

seleṣ, to choose, choice, chosen

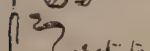

sṯuḫ, to embalm, to pickle


sṯu, to prepare, to embalm


sṯuu u, limbs


sṯuḫ, to moisten, to anoint, to embalm

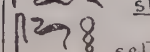
sṯeṣ, to crawl

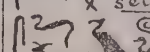

set, to attend to, to oversee, to take care of, to regulate

set, a likeness, a form

sot

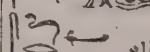
sṯeṣ, sacrifice; sṯefau, to heap offerings


seth, a bird. Cursorius Isabellinus

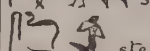

sṯefau, to fulfil, to die

sṯemu, stibium, antimony

" "


seḫer, to assist

sethu, the bones of the leg

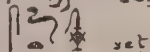

sṯet, to repeat, to pray loud, to sing, to vaunt, to speak aloud, to pray

seṯet, a likeness, a form

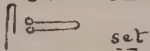
sṯet t, a child

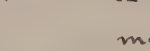
set t, a girl

set, a child, a boy


set t, flame, fire

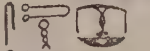
sṯet nu, figure, image

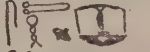

set, the back of a chair, when, and, moreover, also, see, commencing phrases, to envelop, governs the pastern


sti, aroma, perfume

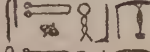
set, (to drag) the people,

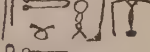
sti hebs, aroma, perfume

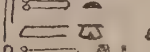

" an offering


" " "

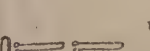
" " "

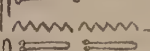

" " "

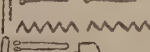

sḏenḏ, stibium

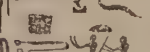

sṯen, tension, extension, direction

sṯen, to place over, to contend, to increase, to aggrandise

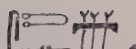

sṯen teni, tension, extension, direction


sṯenten, the end, termination

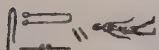

seleṣ, select, observe, try

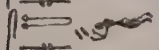

seleṣ, to try

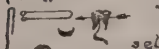
seleṛ, hair, or roots

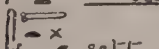

sṯēs, the ether, the upper heights, the regions of the air

sṯēō, to rise, to resuscitate, upright, vertical, perpendicular


sṯēsi, to drag along, supine


sṯēsu, to tumble, to fall

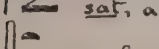

set ṯ, to impregnate

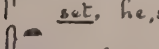

setṯ, to tremble; sti, conduct, return

setaiṯ, to envelope, to cover, to roll up

set ṯ, an ejaculation

sat, a transport boat


sut, he, she, it,


sṯū, they, them, their

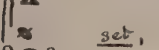
set, to pour out, to spill

set, to bring, to pour

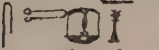
se ṯ, a cake

se ṯ, flame, shine: suat, fire, flame

set, stench

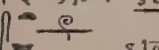

set, corn

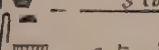
set heb, feast oil, offering oil

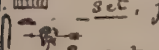

set, to conduct

set, to conduct, to lower

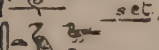
sṯā " "


set, freestone


se ṯ, the neck


set, to lay up a rope

sṯā, to tremble


sṯāui, flame, to light, to burn

sṯāibu, a butcher

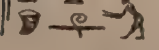
sṯāu, a noose, a cord

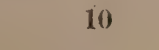
sṯā, to return, to make return, to introduce

sṯāu, an inclined scaffolding

sṯā, a prisoner, to convey

sṯā, to be conducted, to be led


sṯa antiu, perfume (of Anti)


sṯa, towed, led by a cord, conducted

sṯā, a flame

sṯā, a reel of thread or twine

sebṯ a wall

sṯebu, to drink

sṯeb, an act of submission made by Kneeling, striking the head on the ground;

seb ṯ ḫu ṯ, doing honor

seṯef, a sacrifice; sef ṯ a sword

sṯeḥa, to separate, to disunite, to overthrow

" " " discord

sṯi, scent, perfume

sṯēfu, to melt, to refine

sṯi, to offend

sṯi, an odor, a stench, stink

" " " "

sṯi, a vase

sṯimu, a meadow, pasturage

sṯekew, to lead, to accompany

sṯeḳ, to make approach, to lead, to bring

sṯeḳ, to make not to see, to hide

sṯeḳa, to weave

sṯem sṯem, the parts of the body brought into play in walking

sṯem, a high priest

sṯemu, vegetables

sṯemi, incense

sṯen mẖu, to turn back, return

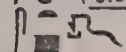
sṯen sṯenem, to turn back

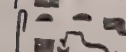
sṯennu, to direct

sṯennu, distinguish, prefer, eminent

set, slū

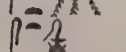
slēn.

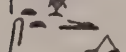

setef, select, chosen, approve


seṭef ṭ, a thigh

seṭeṭ, to draw, to conduct

sṯi, a ray


sṯi, flame, fire


set ṭeṭ, passage, conduct

slū, and, also, moreover, see

slū, a ray

setu w, boys, young people

slūha, pride, to repel, to charm, to bewitch, to fascinate, to separate, to disunite, to overthrow

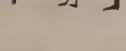
sṯeṭma, a bundle

slū, wheat

slū ". slūha, to repulse

slūr, to surround

sṯūṭ, to paint, to describe, to cause an image to be made


, slūlū, to plant trees, a site

slūu ṭ, to lead

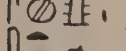
slūuχ, to embalm, to prepare

slūχ, " "

slūr, to surround

slēχ, a recess, a rampart, a ditch

slū, to anoint, moisten, embalm

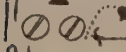

sṯuṭ, to terrify

sṯuṭ, to tremble

sṯuṭ, to consolidate

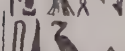
slēχ-χ, to moisten, anoint, embalm

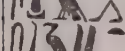
slā, chimera

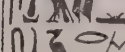

slā, to conduct, to guide, to guide a boat over—

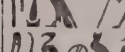
set, sw

setaḥu, the ancles


slāi, to throw, push, thrust


slai ṭ, to amuse oneself, to joke


slāru, overseers


slā χemu, a bat

selā, to amuse oneself, to joke

selēm, to envelope, to clothe, to dress

selēm, to protect

sṯu, to amuse oneself, to joke

selā, to thrust, to throw, to amuse oneself

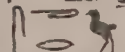
slā, a form, a type

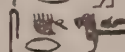
sḳlā, dye

selēmṯ, to envelope, to clothe, to dress

seṭem, to hear, to listen

slēru, harvest


slēr, to lay out, to lie down

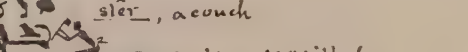

slēr, to lie on the back, supine

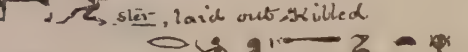
seṭer, bedridden

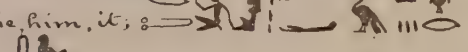
slēr, a couch

slēr, laid out, killed

sw, he, him, it;



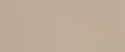

ret u aa her sw, people who are great for it; people who are capable for the work;


, an

en ret u atah aa her sw, bring people who are great (able, strong) to drag stone

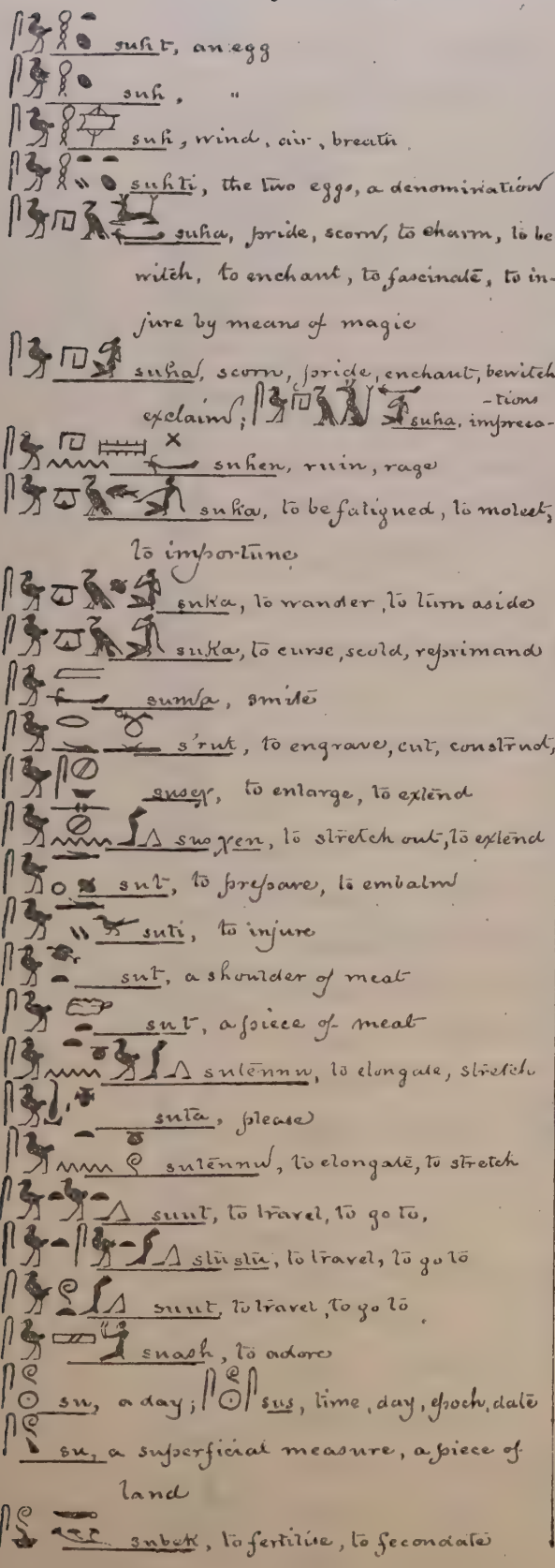
sw, wheat

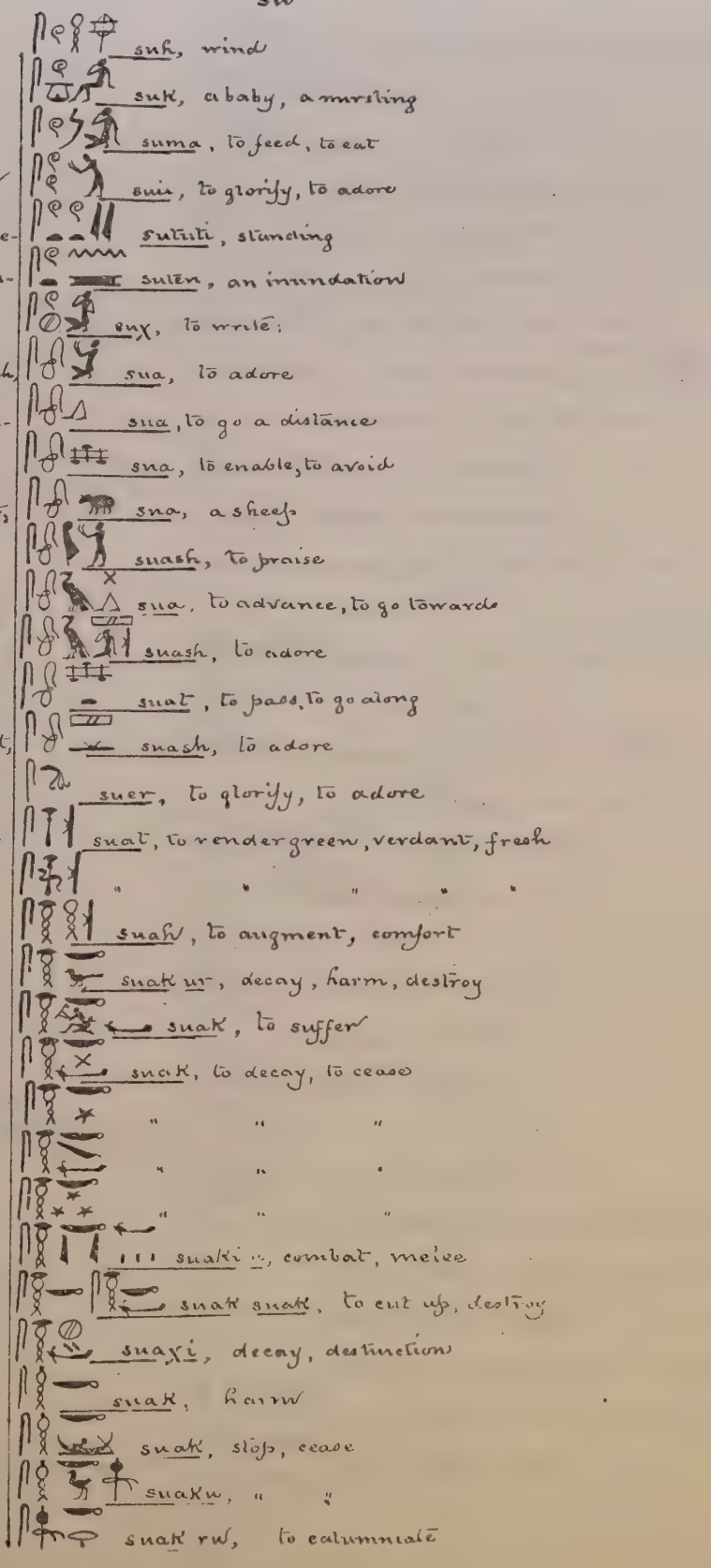
sw, 1/10 of a measure of land


sw, wheat

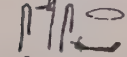
swa, a bond, a band

swḥ, an egg


suhit, an egg
suh, "
suh, wind, air, breath
suhti, the two eggs, a denomination
suha, pride, scorn, to charm, to bewitch, to enchant, to fascinate, to injure by means of magic
suhas, scorn, pride, enchant, bewitch, exclaim; suha, imprecations
snhen, ruin, rage
sukau, to be fatigued, to molest, to importune
snka, to wander, to turn aside
sukka, to curse, scold, reprimand
sumsa, smile
s'rut, to engrave, cut, construct,
snsey, to enlarge, to extend
snsexen, to stretch out, to extend
sut, to prepare, to embalm
suti, to injure
sut, a shoulder of meat
sut, a piece of meat
snlennw, to elongate, stretch
suta, please
snlennw, to elongate, to stretch
sunt, to travel, to go to,
slu slu, to travel, to go to
sunt, to travel, to go to
snash, to adore
su, a day; sus, time, day, epoch, date
su, a superficial measure, a piece of land
snbek, to fertilize, to fecondate


suh, wind
suk, a baby, a nursling
suma, to feed, to eat
suin, to glorify, to adore
sutuu, standing
sulen, an inundation
sux, to write:
sua, to adore
sua, to go a distance
sua, to enable, to avoid
sna, a sheep
suash, to praise
sua, to advance, to go towards
suash, to adore
suat, to pass, to go along
snash, to adore
suer, to glorify, to adore
suat, to render green, verdant, fresh
" " " " "
suahu, to augment, comfort
snak ur, decay, harm, destroy
snak, to suffer
snak, to decay, to cease
" " "
" " "
" " "
snakiu, combat, melee
snak snak, to cut up, destroy
snaxi, decay, destruction
snak, harm
snak, stop, cease
snakw, " "
snak rw, to calumniate

sw, sx


s'user, to maintain

sur to drink

"

"

"

"

"

sut, to transmit

"

sulēb, to nurse, to feed

sex, role, character

sexi, parturition

sex, a fruit or cake

sex, to cut, to slash

" " "

sex, full, abundant

sex, bread

sexat, a hare

sexan, anger, to get angry

xesbet, lapis lazuli, blue

s'xebex, to glide, to insinuate

sexbex, to be attached, hampered, entangled

sefex, seven, f. sexef, to inscribe, enroll

" " "

sxi, deaf

sxi, to elevate, to uphold

sxi, deaf

sexet, to destroy

sxemw, to prevail

sxem, a sistrum shaped mirror

sxem, a shrine

sxem, an image

sx

sxem, to be amused, amusement

sxemex, " " " "

sxemex, to prevail

sxem, a sistrum shaped mirror

sxen, juncture, event

sxenw, to embrace, to enclose

sxen, to stop, to station

sxen, when followed by lēn-hu, wings — to fold the wings

sxen, to admit

sxenw, a promenade

sxen, a prop, to sustain (thee in thy journey)

sxenenw, rebuke, to plead, to tell

sxenen, props

sxenw when followed by sw, to retire; sxen, a residence

sxennw, the breast

sxennwiw, a dyer

sxep, to transfer

sxeḥ, a liquid offering

sxefen, to digest

sxefet, an offering

" "

sxefet, to bear off

sxer, has three interpretations; 1st, plan, project, design; 2nd metaphorically, design, plan, doctrine; 3rd idea, character, habit, a document, cause

sxer, to throw down, to strike

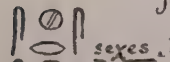
sxer, to throw down

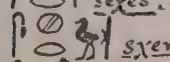
" " "

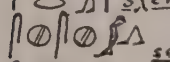
" " "

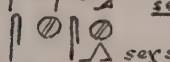
sxer, to overthrow

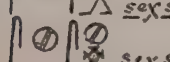
sxeri, a document, a deed, a report


sexes, to run very fast, to hasten


sxeru, fact, condition, situation, state

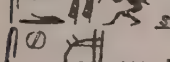

sexsex, to run, to fly, to escape

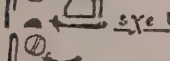

sexsex, to run, to chase


sexsex, amusement

sxet, to capsize, to fall, to throw down

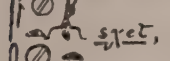
sextī, evil, disaster

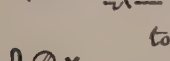

sxet, to lay out nets, to make bricks

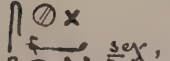

" " " " "

sxet, a weaver

sxet, to capsize, to fall, to throw down

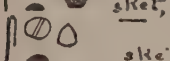

sxet, to wound, disaster, a blow, to flog, to beat


sex, " " " " "


sxet, a field

skes, to squeeze, to knead bread

skes, a cake

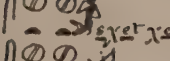

skes, a net, hinder, shut up

skelā, a gate

sxinash, when followed by Kant, a hyena-(rage), sxinash Kant, to be drunk with rage, fury

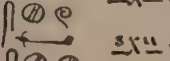
sxet xet, deaf, conversation, argument

sxet xet, to trap, to snare


sxu, gall, bile

sxu, to prepare

sxex t, to protect

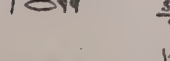

sxex hati, amusement

sxexti, a courier

sxepṯu, encumbers

sxut, confinement, accouchement

sxex, equilibrium, breadth in centre distinction to height


sxua, deaf

sxa, to write

sxa, to write, a scribe

smaama to sulk to grumble, to murmur

sxa, to recall, to remember, memory, study examine, reason, deliberate

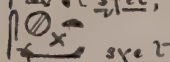
sxa, a scribe

sxai, a letter, a writing, a memorandum, to write, to inscribe, to prescribe, to order, to publish, to divulge, to design, to paint, to imagine

sxa, to remember, to recall, memory, study, examine, reason, deliberate

sxau, to write, a scribe

sxai a letter, a writing, a memorandum, to write, to inscribe, to prescribe, to order, to publish, to paint, to divulge, to design, to imagine


sxaru aa, to teach a trade

sxex to prepare

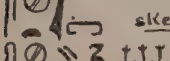
sxaxa, to have a vivid recollection of — to honor a memory

sxaxau, " " " " "

sxat, a fowler, a weaver, an artisan

sxem, a duration of time,

sxu, to remember, to recall, memory, study, reason, deliberation


sxax, when preceeded by , immediately, instantly

sxa, to make

sx

sxa, to make

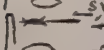
sxa, to write, inscribe, paint, design

sxa, to make

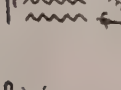
sxa, deaf

sxar, to extend

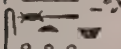
sxer, to clothe, accoutre, furnish

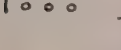

sxanew, to breach a wall by means of a catapult

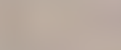
sxat a hare

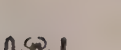

sxat, an offering of two kinds;
sxat hut, white sxat
sxat nab, green sxat

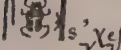
s'xeper, to make live, to nourish, to give life to.

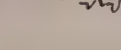

s'xeper to produce, to make, to transform one thing into another


sxa, to embellish, to ornament

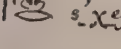

sxat u, grain


sxat her, deaf

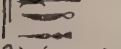

sxut, to inform

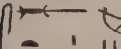

sxu, to illuminate

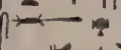
sxu u, celebrations, formula of celebrations


sxu, to understands

sxu u, celebrations, formula of celebrations


sxaker, to embellish, to ornament


sxem, to prevail

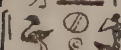

" "

" "

" "

sxat, a plantation

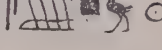
s'xu, or s'xshu, to multiply


seshent, to establish, to institute (infra)

sesh

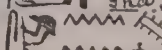
s'shespu, a cucumber

s'shepw, to illumine, to render brilliant.


s'shepx, sphynx

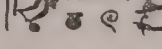
shew, the litany

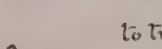
s'shenen, to breach a wall by means of a catapult


sxennw, to torment, to plague, to treat with violence, a malefactor

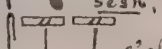
sesh, a purse

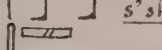
s'shebsheb, to vomit

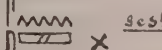

seshen, to work, to tie

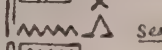

seshen, to turn towards

seshen, to suckle, to feed

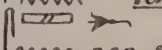

seshen, lotus seeds


sesher, to bleach linen, orbit of planets

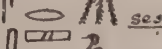

seshnw, a portion of the body?


seshes, to spew

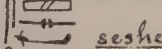
seshet, a hole, round


seshet, a recess

sesht, grain, food


s'shenti, to bring back

seshet, a hole, round

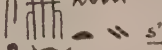

seshet, a crown, diadem, circlet

seshet, a fillet

seshet, a scroll

seshet, a window, niche, alcove, the place where prisoners or booty were secured

seshet, to circulate

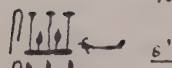

seshet, a comet or a planet

seshet, a preparing house

" "

seshet, an account, a list

s'het hetera, to mount a horse


s'sha, to commence

s'sha, a kind of vegetable

su, she, her, it

sa, a person, an individual

seb, five, 5

ses, six,

si, to pass away, to corrupt

su, they, them, their

, a place, a part

saali, wounders, annihilators

sami, fishermen

safe, to count

sau, to drink

sab, an ox

sab, to ornament, to dress, a jewel box

saah, a mummy

saah, " saau, a post

sah, a kind of collar

sah, mad ?

sah, a mummy, a body, a spirit form, eidolon

sahu, a mummy

sahu, a kind of collar

sahu, a nobleman, ancestry, family

sahu, to incorporate

sahu, a mummy

sai, to be tired, worn out, overcome

" " " "

s'ak, to direct, to make enter

s'am, to eat, to devour, to swallow

" " " "

saniu, to eat, swallow, feed

sam, clover, fodder

sam, to drink, to enjoy

s'aam, to eat

sanu u, cakes, to feed

sar, to push, to make walk, to make mount; sari tetu, to carry words, to carry a message

sata, to become guilty

san, an arrow

sanuu, a bath

sannut, a bath, a medicament

sannu, to punish by forcing to pay

sannu, " " "

sannu, the price, payment

saw, clay, sealing clay

seb, to pass, to traverse, to transport, to go from one place to another

seb, a bad pass, misfortune

seb, to delude, unfastened hair (of prisoners who are held by it by Pharoah in the act of decapitating them)

sebii, an interrogative form of, who, how &c: mesbutiu, bales, packages

sebbi, to go from one place to another, to pass, to traverse, to transport

sabu, a flint; sanu, embellish, to put in order

sak, a kind of gryphon

sak, a basket made of reeds.

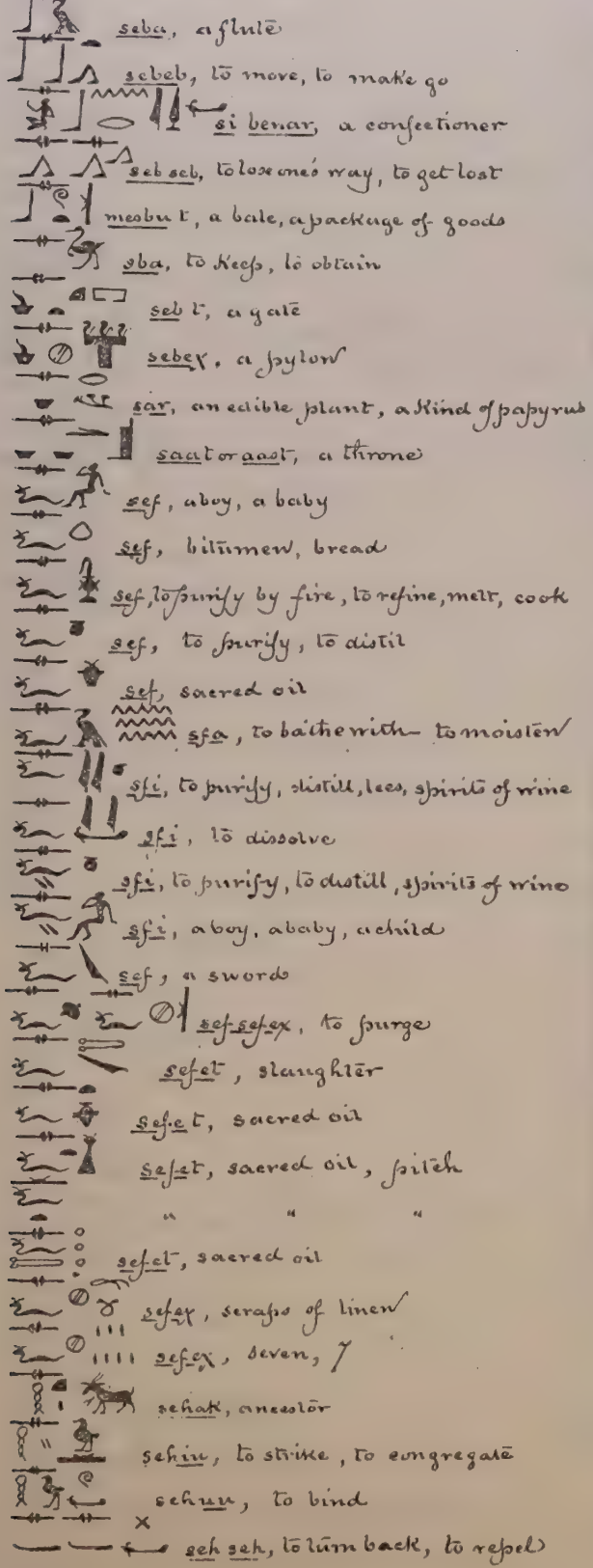
seb, to delude. sebt mensh a pilot

seb, to bring

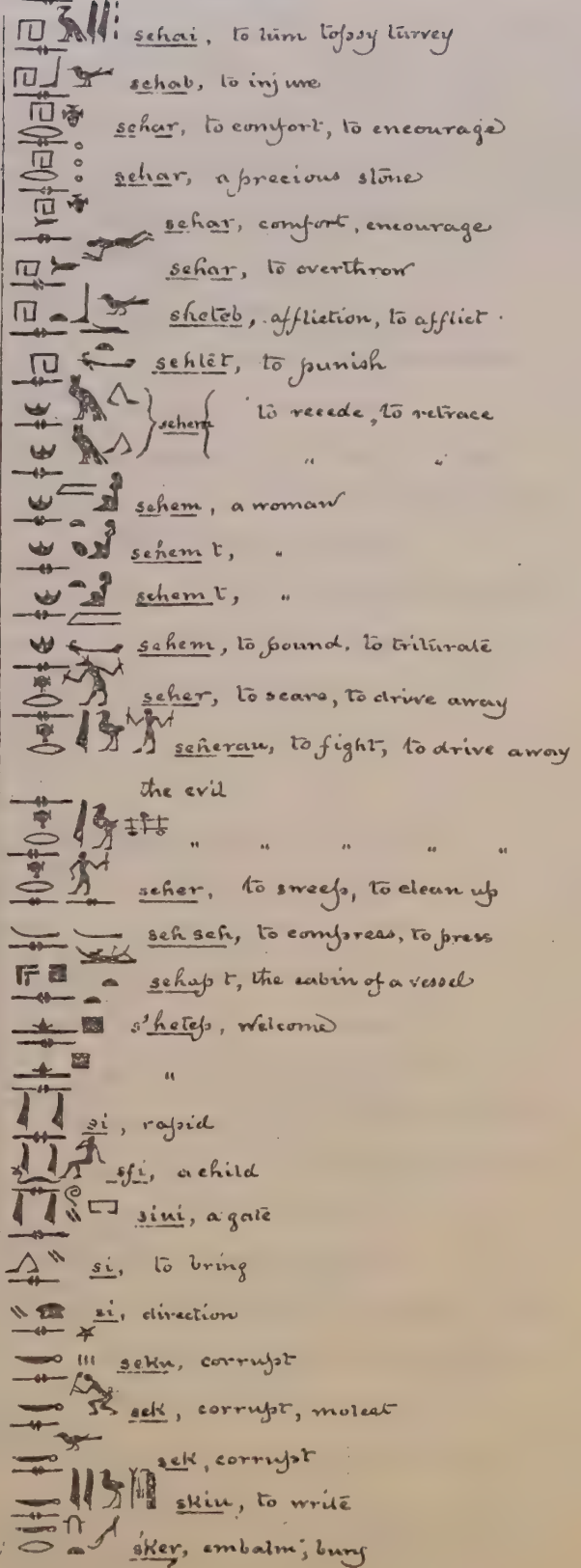
seb, a jackall

seb, to play on the flute

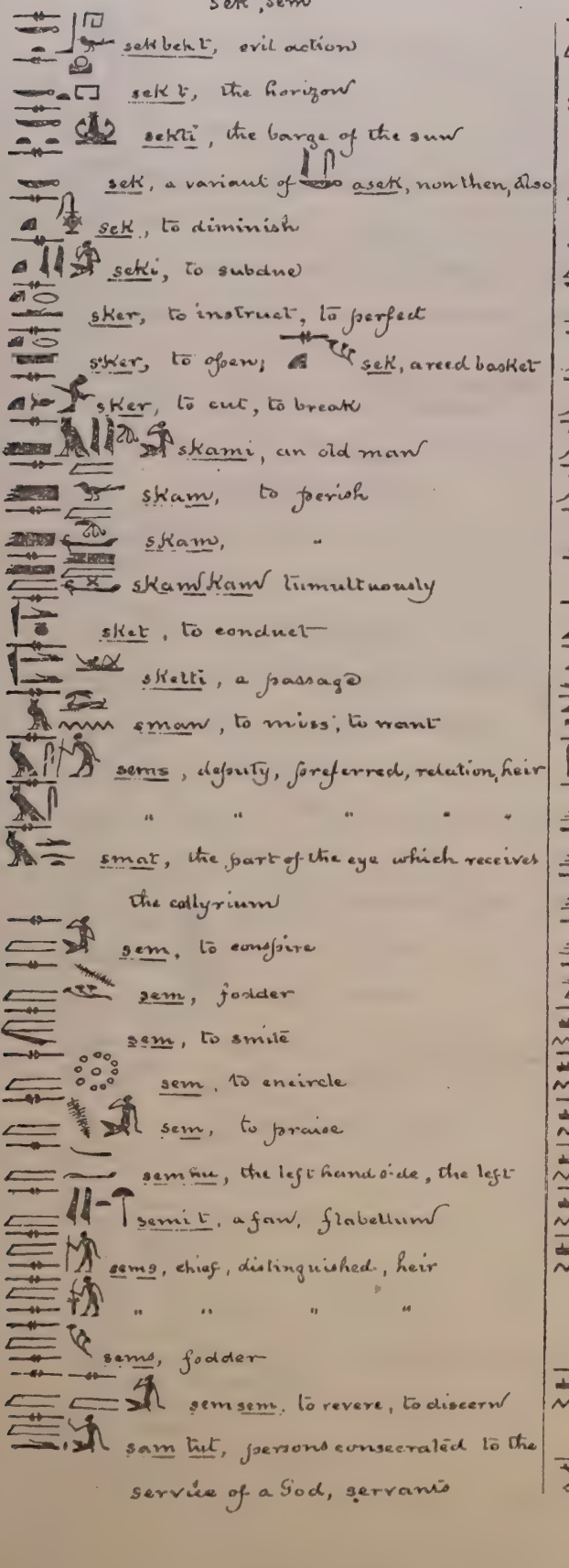
Seb, sef


seba, a flute
sebeb, to move, to make go
si benar, a confectioner
seb seb, to lose one's way, to get lost
meabu t, a bale, a package of goods
sba, to keep, to obtain
seb t, a gate
sebeq, a pylon
sar, an edible plant, a kind of papyrus
saat or aast, a throne
sef, a boy, a baby
sef, bitumen, bread
sef, to purify by fire, to refine, melt, cook
sef, to purify, to distil
sef, sacred oil
sfa, to bathe with — to moisten
sfi, to purify, distill, lees, spirits of wine
sfi, to dissolve
sfi, to purify, to distill, spirits of wine
sfi, a boy, a baby, a child
sef, a sword
sef-sefex, to purge
sefet, slaughter
sefet, sacred oil
Sefet, sacred oil, spleen
" " "
sefet, sacred oil
sefex, seraps of linen
sefex, seven, 7
sehak, ancestor
sehiu, to strike, to congregate
sehuu, to bind
seh seh, to turn back, to repel

Seh, sekh



sekˊ, semˊ



sekˊ bekˊt, evil action

sekˊt, the horizon

sekˊti, the barge of the sun

sekˊ, a variant of asekˊ, now then, also

sekˊ, to diminish

sekˊi, to subdue

sˊkerˊ, to instruct, to perfect

sˊkerˊ, to open; sekˊ, a reed basket

sˊkerˊ, to cut, to break

sˊkamˊi, an old man

sˊkamˊ, to perish

sˊkamˊ, "

sˊkamˊ kamˊ tumultuously

sˊketˊ, to conduct

sˊketˊti, a passage

smanˊ, to miss, to want

semsˊ, deputy, preferred, relation, heir

" " " " "

smaˊt, the part of the eye which receives the collyrium

semˊ, to conspire

semˊ, fodder

semˊ, to smile

semˊ, to encircle

semˊ, to praise

semˊnu, the left hand side, the left

semiˊt, a fan, flabellum

semsˊ, chief, distinguished, heir

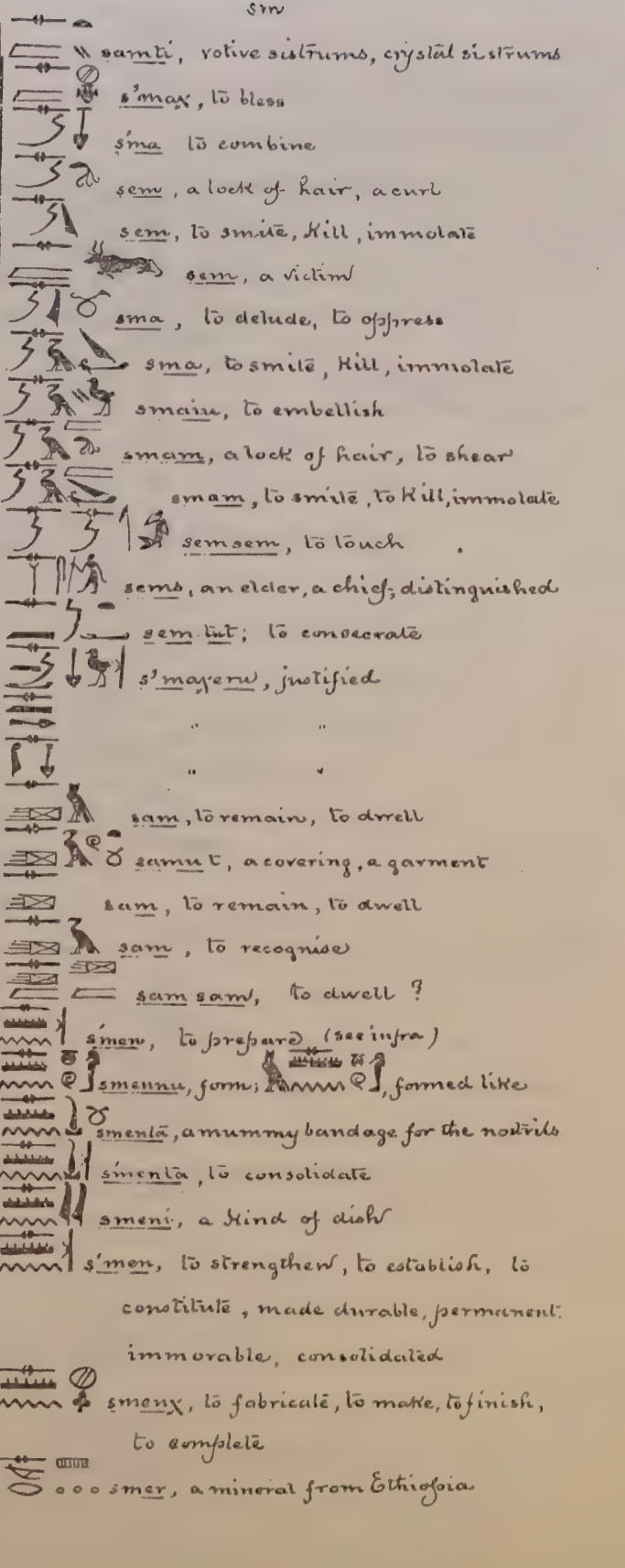
" " " "

semsˊ, fodder

semˊ semˊ, to revere, to discern

samˊ hiˊt, persons consecrated to the service of a God, servants

smn



samtiˊ, votive sistrums, crystal sistrums

sˊmaqˊ, to bless

sˊmaˊ to combine

semˊ, a lock of hair, a curl

semˊ, to smite, kill, immolate

semˊ, a victim

smaˊ, to delude, to oppress

smaˊ, to smite, kill, immolate

smaiˊu, to embellish

smamˊ, a lock of hair, to shear

smamˊ, to smite, to kill, immolate

semˊ semˊ, to touch

semsˊ, an elder, a chief; distinguished

semˊ hiˊt; to consecrate

sˊmayˊeˊw, justified

" "

" "

samˊ, to remain, to dwell

samuˊt, a covering, a garment

samˊ, to remain, to dwell

samˊ, to recognise

samˊ samˊ, to dwell ?

sˊmeˊw, to prepare (see infra)

smennuˊ, form; , formed like

smenˊtaˊ, a mummy bandage for the nostrils

sˊmenˊtaˊ, to consolidate

smeniˊ, a kind of dish

sˊmenˊ, to strengthen, to establish, to constitute, made durable, permanent, immovable, consolidated

smenˊx, to fabricate, to make, to finish, to complete

ooo smerˊ, a mineral from Ethiopia

SM, SW

smerw, to bind, to swathe

smes, rejoice

sen, they, them, their

sen.u, " " "

sen, to pass from one place to another, to overrun, equality, conformity

samu, to unite; to join, to assemble, shut

sen, to breathe; her sen ta, breathing on earth, to prostrate on the ground

" " " " " " "

sen, to breathe

sen, a guide to guide

sen, to carry away, to transport, to split

sen, sin, impurity, uncleanness, id.

senta, to prostrate oneself

snat, chess or draught board

sen, to pass, to traverse

snan t, pass over, transgress, trespass

snaa, to paint

snaa, to write

s'en aat, to increase

snef, blood; snef anyu, blood of animals

senf, a sword

senf, blood

" "

senh, to bind, to tie,

senhu, to bind, to attach, to put in chains

senhu, to binds

senha, to register to train, to choose

SW

senhaa, to register, to write down

soahe, to bind, to register, to convoke for a choice, to choose, to train soldiers

senhaw, " " "

senhi, " " "

senhas, to arouse, to excite

senhw, a prison

seni, a cattle; the cabin of a boat

senitu, to prostrate oneself

seniw, thieve, thief

seniw, " "

senku, a ray of light

senikti, to shoot

senku, night, darkness

senku, to suckle

senkw, "

senemu, to sympathy

senem, to fill, to nourish, plenty, abundance

senemu too high an inundation

senem, mourning

senamm, to devour

senmem, fill, nourish, abundance

senmem, dressed hair, a curl, tress

senk, a ray of light, a sunbeam

senki, a sunbeam

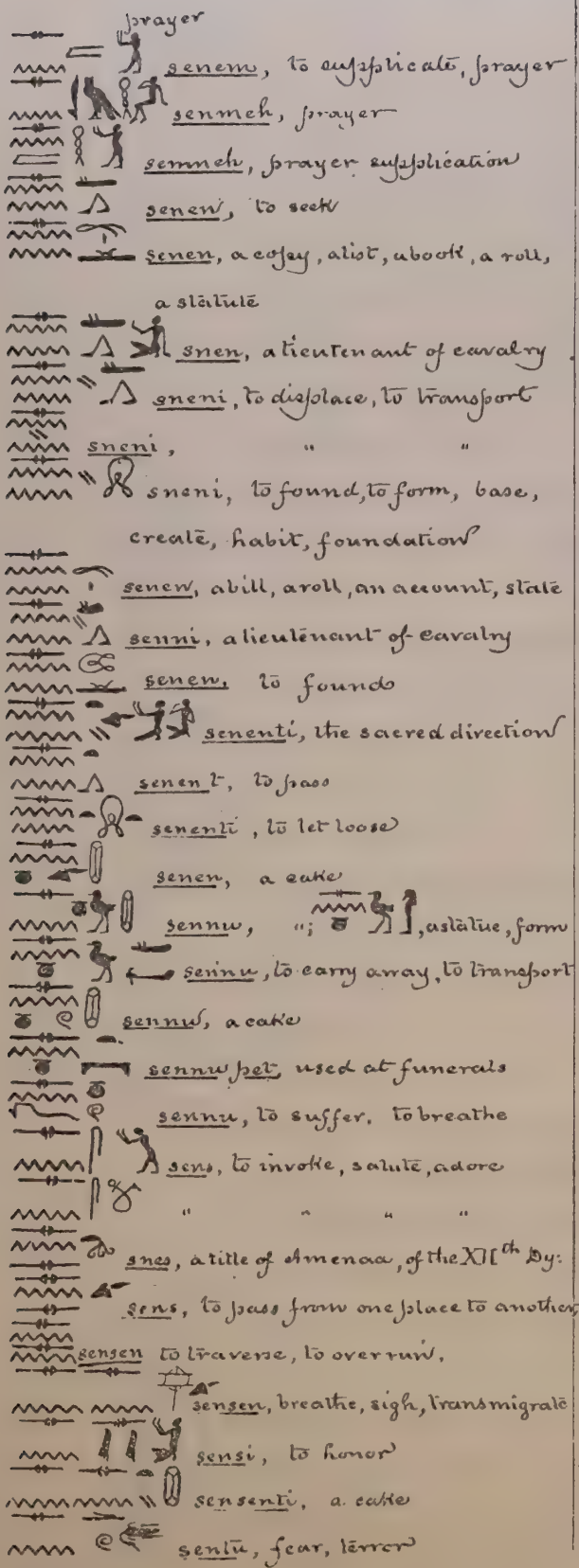
senki t "

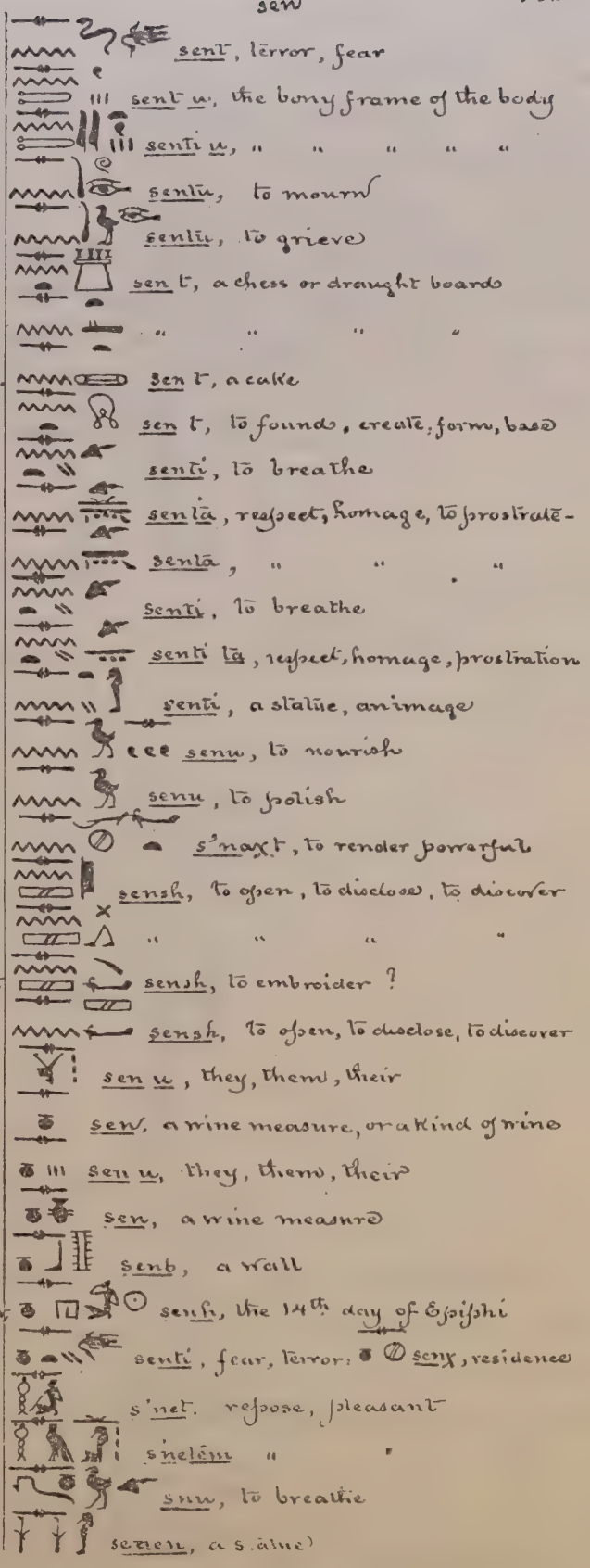
senck, to suckle

senenu, to fill, to nourish abundance, plenty

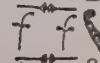
senmem, dressed hair,

senmeh, the humble attitude of

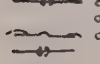

prayer
senemu, to supplicate, prayer
senmeh, prayer
senmeh, prayer supplication
senew, to seek
senen, a copy, a list, a book, a roll, a statute
snen, a lieutenant of cavalry
sneni, to displace, to transport
sneni, " "
sneni, to found, to form, base, create, habit, foundation
senew, a bill, a roll, an account, state
senni, a lieutenant of cavalry
senem, to found
senentí, the sacred direction
senent, to pass
senentí, to let loose
senen, a cake
sennu, "; , a statue, form
seinu, to carry away, to transport
sennu, a cake
sennu pet, used at funerals
sennu, to suffer, to breathe
sens, to invoke, salute, adore
" " " "
snes, a title of Amenaa, of the XII[th] Dy:
sens, to pass from one place to another
sensen to traverse, to overrun,
sensen, breathe, sigh, transmigrate
sensi, to honor
sensenti, a cake
sentu, fear, terror

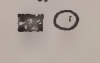

sent, terror, fear
sent w, the bony frame of the body
senti w, " " " " "
sentu, to mourn
sentu, to grieve
sen t, a chess or draught board
" " " "
sen t, a cake
sen t, to founds, create, form, base
senti, to breathe
sentā, respect, homage, to prostrate-
sentā, " " "
senti, to breathe
senti tā, respect, homage, prostration
senti, a statue, an image
senu, to nourish
senu, to polish
s'nax t, to render powerful
sensh, to open, to disclose, to discover
" " " "
sensh, to embroider ?
sensh, to open, to disclose, to discover
sen w, they, them, their
sen, a wine measure, or a kind of wine
sen w, they, them, their
sen, a wine measure
senb, a wall
senh, the 14th day of Epiphi
senti, fear, terror; senx, residence
s'net, repose, pleasant
s'nelem "
snw, to breathe
senem, a statue

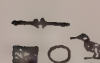
snew, a statue

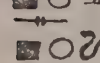

snew, a coffer, list, roll, book, statue

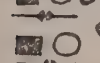
snew, a valuable stone


snew, a substance


sep, times, or sep na once; sep sen, thrice; sep xemt, thrice re; to choose, the chosen, exquisite, excellent, virtue, harvest, again, commencement, at the same time


sep, rebut, repulse, refuse, clique


sep, a mythologic serpent, the curmudgeon


sep, the lips

sepi, the two plumes of the Atef crown

sep, a feather, a judge

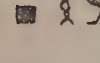
sep, corrupt

sep, time, turn

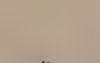
sep, a throne

sepshu, to enclose, to enchain, to make captive

sephui, to torment, to torture, to chastise


sepshu, an order

spshw, a ceremony performed with the victim for sacrifice; after it had been washed it was led to the shambles in the sanctuary

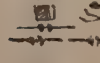

sepsi, the double plume of the Atef crown

sepsi, to spare

sper, to go, to reach, to arrive at-

sper, a wish, a vow

spes, to kill

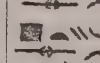

sepsep, to lead away, to seduce,

a fraud, to deceive

sept, to destroy

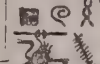
sept, shore, beach, margin

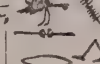
sper, the lips

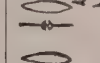

sperti, the two lips

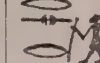
sperti, shore, the banks, beach

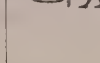
spu, to drag, to chain, to bind

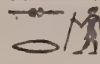

spuh, to drag, to impede


spa, to fly


ser, to fall.


ser, to venerate

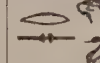

ser, (a noble), a superintendent, an overseer, a governor


ser en per, the almoner of the house, Pharoah's almoner

ser, a giraffe

ser, to console, to arrange

ser, a goat of the sheep kind


ser, a goose

" "

" "

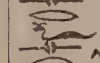
ser, to arrange

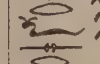
ser, an arrow

" "

sera, a goose

seraw, a ram, a sheep


seraw, private, reserved.


serf, a blast, a hot breath

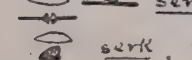
serf, submerged, inundation, (to) water

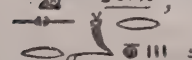
serf, " " " "

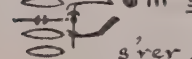
seri, sick

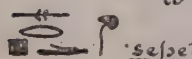
seri t, screen, flabellum

serk, to perfect

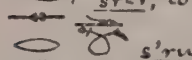

serk, to feed, to supply

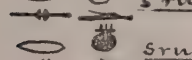

ser mer, a fermented liquor

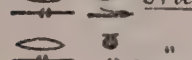

s'rer, to distribute, to arrange, to engrave, to sprick

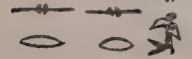

seseṛ, a plant growing on the banks of the Nile

srer, to write, to describe, trace, determine


s'rut, to dig, plant, to engrave

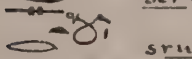

srut, to dig, to plant, to grow


" " " "

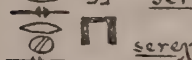

serser, to sorrow, to intend to design

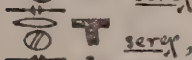
ser t, a screen, a fan

ser t, to plant, grow, fecundate


srut, to cut down

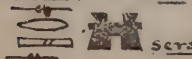
serie, butter

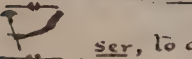

serex, a door, a pylon

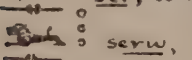

serex, " "

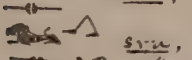
ser xefsesh en ser aa, superintendent of the royal workshops

sersh. a standard, a name

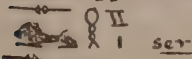

sersh, a pylon


ser, to arrange, to engrave

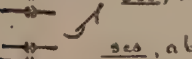

serw, a part of a chapel's ornament

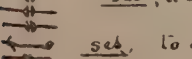

srw, to bend

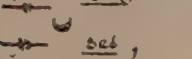
seraw, a ram


serh, to draw

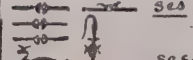
ses, a horse


ses, a bolt, a bar


seb, to give rise to

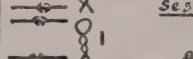

sel, ?

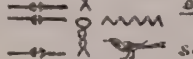
ses, to breathe, to respire


sesef, to melt, to consume

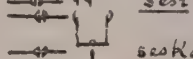
sesefṛ, disgusting

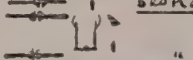
seshes, to drag

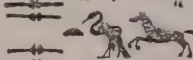

seseh, to tie, to bind, to chain

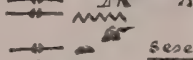

seshew " " "

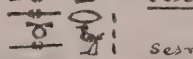
sesiṛ, a flame, to flame

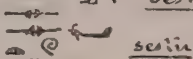

seskw, the back, the shoulder


" " "

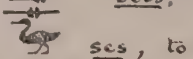

semut, a mare


sesenṛ, to breathe, to respire


sesrw, arrows

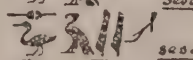

serin, the rope of a net

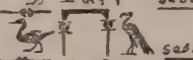
sebs, she, her, it


ses, to embellish

sesa, to despise

sesa, to guard

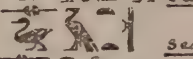

sesai, supports, upholders


sesa, " "

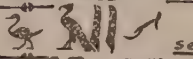
sesat, to omit, to fail

sesat, " "

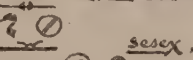
sesati, to catch, to noose


sesati, to guard

sesaw, terror


sesai, a post, a shore

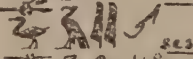
Sesanaw, to guard


sesex, to adore, to illumine

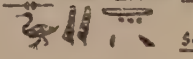
sesati, to catch, to noose

sesaut, to make to tremble, frighten

sesa, to progress, to advance

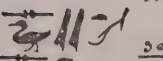

sesai, beam, scantling, floor planking

sesab, to teach

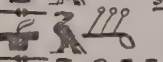

sesi, dome

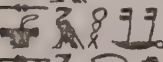
ses, sṯ

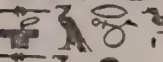
sesaṯ, a beam, a scantling, the planking of a floor


sesi ṯ, " " " " " "

sesa, the back, the wall

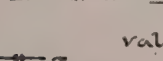

sesa, to perambulate

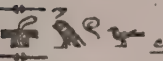

sesaḥ, "


sesar w, celestial stations

sesaṯ, the tomb, Hades

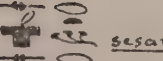
sesa ṯ, to weaken, feeble, of little value, soiled, impure


sesau, negligent, deficient


sesaḳ, to contract, to tighten, to to unite, to approach, to assemble

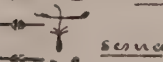
sesar ṯ, wheat

serer, to dig

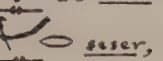

seser, perverse

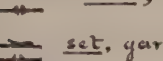
sesna, to sing

sesw, sing

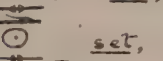

seser, to sing aloud

seṯ, garnished, adorned

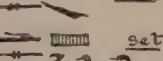

seṯ, to put on a garment


seṯ, to illumine

seṯ, stibium.

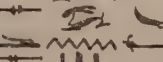

seṯ, to explode

seṯ, limestone

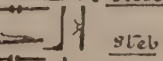

sṯāu, trouble, to tremble

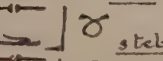
sṯāu w, troubles

sṯān, to push


sṯēba, active, assiduous, attentive

sṯēb, " " " "

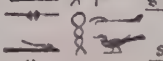

sṯeb, to wrap, to prepare

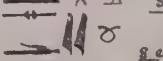

sṯēb, " "

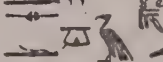
sṯēbuḥu, active, attentive, assiduous

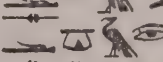
sṯ

sṯēḥ, to open

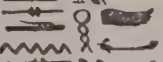

sṯēḥ, to lower

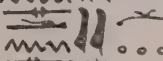

seṯi, a garment


sṯēka, to hide


sṯēka, "

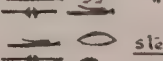
seṯem, to hear, to listen


sṯēnḥ, to fly


sṯēni, grain

sṯeṯ, to flutter, to tremble

" " "


sṯēṯēr, to frighten

sṯēṯ ṯ, a tail

sṯuṯēx, to embalm, preserve

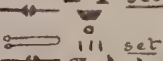
sṯēx ?

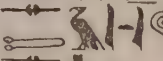
seṯ, a child

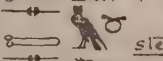
seṯ, a child, race

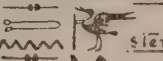
seṯi, child, children

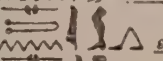
seṯi, a flame, fire

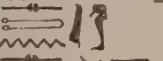

seṯ, incense

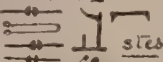

sṯāiṯ, a cord, a rope


sṯēnw, to clothe, to wrap


sṯēn, to make, to reckon

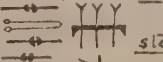

sṯēnā, to separate, distinguished

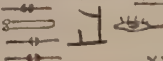

" " "

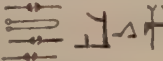

sṯēs, the ether, upper regions of the air

seṯeṯ, a deadly, fatal deed

seṯ en mu ab, a draught of pure water


sṯēs, the upper regions of the air


sṯēs, soride, to exalt


sṯēs, ? bas ?

sṯeṯ, a water jar, a liquor, a beverage

annw sṯeṯ ab, a stone on which libations were made

selēmt, a hoe.

slēs, to charm, to enjoy

set, they, them, she, a bird (anas acuta), that or it; set er ra a, that which I do.

set, a female,

Set, a sunbeam

set, land, rock, hill

set, a rock, hill

set a palette, a bolt, a bar

and set u, grain

set, a goose, 'anas acuta'

" "

slēf w, to foam, to froth

slēf, the inundation

sef r, the sword, to put to the sword

setha, to remove

seti, 'copulare'

sati, an arrow'

setka, to hide, to conceal

selēk ennui, to accompany

selēf, the thigh, choice, approve

selēf sw, Pharoah or Pharoahs palace; a royal pilgrimage or act of charity while on the pilgrimage, or some royal act of distribution. "he performed the selēf sw"; to approve

slēr, incensed

slēru, to pour out, flow, bleed

slēr, afraid, tremble

seti, the hand, id:

seti, to trap, catch, to noose

sēnt. to make a figure, statue

set, track, trail, foot print

set, to lay up a rope, cord, a cloth

set, to plant, found, establish

set, a freestone

set, odor

sti, hair

sti heb, one of the nine sacred ods

selēx, to weave

sulēx, to moisten, to anoint, to embalm

slēr, to extend, to prolong

slēr, that which is left, the remainder

sleri, to lay out

slēs, to tie

suht, an egg

suha, to pray, to adore, to argue

suha, " " "

sut, to seek

surut, a bird, bombicillo, Corax garrula

sulēx, to embalm, to preserve, to pickle

sutq, to assail

su, they, them, their

su, to advance, to go towards

sui, darkness

sēnt, to engrave, to plant, to dig

suu, a district

suu, glorification

sulēn, the inundation

sinaw, to beam

su, to strike, to overthrow

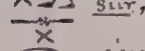
suash, to adore, to praise, glorify

sura, to drink

surt, a chain

s.a, seḫ

sur, to advance, to go towards

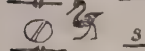

s'ur, to drink

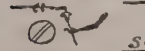
s'ulā, to heal, to make a sound

sul, a kind of bread

seḫ, to cut, to wound

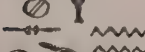
seḫ, to salute

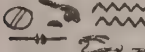

seḫ, to rule, to protect

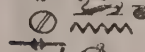

seḫ, to wound

seḫ, liquid

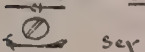
seḫ, idle, languish, deficient


sḫan nw, angry, angered


seḫeb, to drink, id:


seḫ, to go towards, to extend

seḫef, to stop, to turn


seḫef, the inimical, the enemy

seḫi, deaf, deafness

seḫi, " "

sḫem, a sanctuary

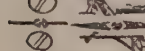
" "

" "

" "

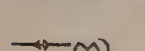
sḫemw, to be idle, deficient, to languish

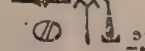
sḫem, to thresh wheat, to pound, to bray in a mortar


sḫen, to embrace

sḫen, the breast, to embrace

sḫen, a hall, a place


s'ḫen, to give breath to-


sḫen, a part of the victim's body

sḫeni, to sustain, stop, to station

sḫennw, to alight, to prop, sustain

sḫennw, a prop, a pillar, to sustain

sḫ

sḫennw, to solidify, to strengthen, to make firm, to consolidate

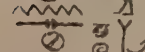
sḫent, the double crown

sḫeps, to create

" "

s'ḫesper " seḫeps, incense altar

sḫer, to strike, to wound, to throw away, to dig, to excavate


sḫer, to declare

sḫer, a picture, a plan, a scheme

sḫer, to overthrow, to cut

sḫer, " "

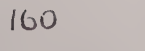
sḫer, to overthrow, to capsize

seḫet, " "

seḫt, to weave, cloth

sḫet, to net, to trap

sḫet, a net


sḫet sa u, to invert

sḫet, to adore

sḫet, an ark

sḫetw, a region, a field

s'ḫeḫ, to balance, to adjust

sḫeḫ, a measure of length

sḫa, to praise, to glorify; sḫa han ef ron en neb naḫt peri am ef, H.M. praised the names of all the victorious lords who issued from him; i.e. praised his own sons (who participated in the victory).

sḫa, to command, to order, to depict, to represent

sḫai, influenced

humors which issue from the body of a dead, the name of an oil or ointment used in preparing the mummy for burial

seshtā, the cloth used for mummy bandages

seshtā, mysterious, hidden, secret

seshtā, mysterious, secret, closed shut, a region, the place of a gate

seshu, a ring of metal or a cover

seshes, a sistrum

" "

seshes, to open

seshesua, ? a substance

seshet, a slip, a deed

" " "

" " "

seshet, a swathe, wrap, a circlet

seshet, combustion

seshet, hair, curly hair

seshetiu, preparers

s'shep, to give light, to illumine

s'shepu, to clear up, to give light

seshresh, a sistrum

se, a son

se en Kep, son of the sanctuary, consecrated

se, some material, jasper

sehesh, lapis lazuli; xesbet, id.

xenem, jasper; xesbet, lapis lazuli

xenemtāh, to be delighted

se, a son; ak, to enter

se, a piece of land containing 200 ells

sei, two sons

senhemuu, a grasshopper

senhemuu, locusts

senu, a reed, a plant

senshauu, doors

sa, bread or food mentioned in the offerings

sen, part of a beeve

sen, a kind of grain, an ingredient of the Kyphi

set, a daughter

set, the soil, the deck of a vessel, floor

" " " " "

" " " " "

selā, a mythological serpent

set, floor, stone

aqu, to enter

sa, behind, after, following; em sa, afterwards, following; her sa ta, on the earth

sa, a wise man, a learned man

sa, the back

sa, beast

sa, a wall

sa, satiate

sai, a diadem

saru, a reed

saw, to watch

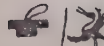
saui, gold

sakatu, a donkey colt

saarutā, hair, wool

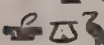
samtu, the temples

sabserw, breakfast

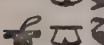

sbairw, to carry a load, to carry an armful of flowers

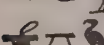
si, to drink

sakel, a mariner


saka, a sack

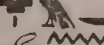
sak, insane

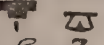

saka, to go, to walk

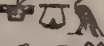

sakarulā, something made of wood

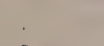
samaklā, a beam, a pillar, a prop

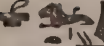
samaklw, " " "


sankar t, ?

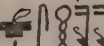

sakabi, drink

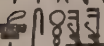

sarmaw, a name of the inundation

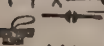

samtii, to gleam


samtii, to gleam

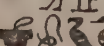
sah, to assemble, to approach, to meet

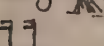

sah, a journey, a passage


sesnaw, to anoint

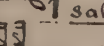

saw, a wall, a partition

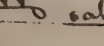
suaba, a circuit, a detour


sahu, to journey, the constellation Orion

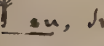

sah, to be gratified

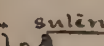
sah, to assemble, to meet, to approach, to reach


su, he, him, it, su, very fine linen


sulēn, King, royal

or sulēn, King, Pharoah


su, royal linen


suaw, a priestess, a singer

suaw, to cry aloud

suau, ?

suaw, the South's abode

suat, a festival to color

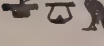
suat, to sing

sati, a priestess, a singer

seiat, lads

suai, singing woman

sukher, a title


sulēw mut, the King's mother

suen ṯoer, abode of the south

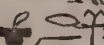
su heteṯ, welcome, a salute

su, to play the harp

sunsw, to nourish, to suckle

sumsh, the south

sumaw, "


sulēn, King, royal

" " "

" " "

sulēni, Kingdom, dominions

sulēni, " "

sulēn, a King, Pharoah

" " "

" " "

sulēw, the south land, southern abode

sulēn met, the 30 judges, ten of whom were selected from each of the cities of Heliopolis, Memphis and Thebes: they formed a senate.

sulēn, very fine linen, royal linen

sulēn, a kind of flax from which very fine linen was made

sulēn, very fine linen

sulēn, to direct

su, sa

sutennu, very fine linen

sualekaka, an insect, Xylophagus

sua nu nu, " " " "

sua abond, abandon

su, he, him, it

suta, furniture

sut, a shoulder dressed

suti, to burn, to destroy

suti, freestone

su, grain

sutenhetepti, an initial formula, of the royal funereal tablets, meaning an oblation, a propitiation

" " " " " "

" " " " " "

" " " " " "

" " " " " "

sa, behind, belly, waist, center, amulet, preparation, virtue, rank, order, a kind of soldier, protection, aid, soul

sa, the back

sa, to prepare, to aid

sa hu, behind

" " "

s'hut, to illuminate

sa, an amulet

san u, genuflections, guards

s'hut, daylight, to illuminate

samt, burial

samta, "

or sa. the back, warmth, efficacy, ornament, amulet, bandage,

sa

thong, behind, charm, grade, rank, to uphold, to protect, a class of priests

sa, a file of soldiers, tribe, section, family, corporation, class, body of--

sa, the ground, the soil

" " "

" " "

hesept, a division of land, a nome or a province

tet, a domain, a quarter, a locality

tam, to rob, to pillage, to finish, to exhaust, to exterminate, to perfect

sennui, to pillage, pillagers

setti, to steal

hesept, a nome, land, rock

hesept en nut, the divisions, or quarters, of a city

tat, a liquid or a kind of grease

tat akeru, the meat

tennun, weaver

un, greased

sa, to touch, the exterior mummy swathe

sa en hani, (dwell of length of time) a lifetime, 110 years

sa, to drink

sa, to perceive, to understand, to comprehend, to inquire into

sa, a cloth, a fringe

sa, the 14th & 15th days of the month

sa, to recognise

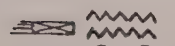
sa, intelligence

saut, a covering, a garment

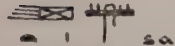
saw, to touch, to perceive

sai, jewels, ornaments

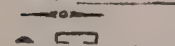
sai, to know by sight, to perceive, to recognise


Kanenti, a title

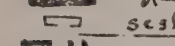
probably
xant, anger


sat, woof, loom

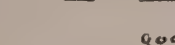
saw, to take, to receive


sxem, a sanctuary

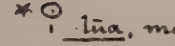
sesh, a nest

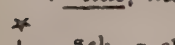

seshi, a priestess, a sistrum player

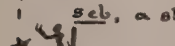
seb or tuat, a star, five, 5, adore, soul, god, divine


tua, morning time

seb, a star, a soul, divine


tuat, to adore;


" "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" "

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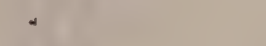
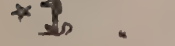
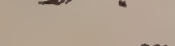
" " 
tat

an Teti mes seb en hetu, said Thoth, the divine father of the King-

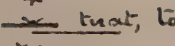
tuat, to adore


sebu, the gods

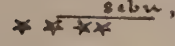

forty, or 5 x 8

tua neter, God of the morning

tuat neter ha, a sacerdotal college, an assembly of worshippers


seba, to adore

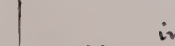
seba, to protect


seba, a harbor in the Red sea

seba, morning time, to do anything next morning that is spoken of in the present time

sebai or tuai, the morning, the morrow

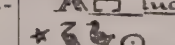
tuat, Amenti, the inferior regions


tuau, to adore

" "

" "

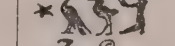
sebau or tuau, morning, the morrow

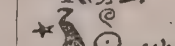

sebaw, a gate

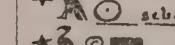
sebauw, to honor, to adore

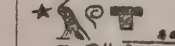
sebaut, a gate

seb or tuat, morning

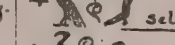

sebt, a gate


tuawa, to adore


tuauaw "

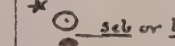

tuat, adoration

sem, total, combine, join

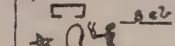

sem, to combine, assemble, unite

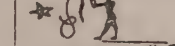
sem, a chief, a deputy

sem, a conspirator


sem, fodder, herb, grass

or sem, the double plume


sem ta, burial, tomb, grave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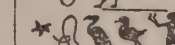
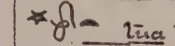
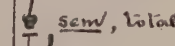
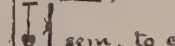
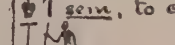

sem ta, burial, funereal proceedings, tomb, grave

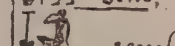

sam tani, Horus the governor of the two regions


samu, a lock of hair, wool


smi, a partner, an accomplice


samu, a sacerdotal function

samw, to combine, unite, circle

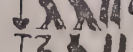

sam, a bed, mat, bench

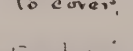
sam

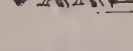
samta, burial, tomb, funeral

sa, a road, a way

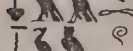
sami, to flock, a flock

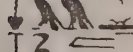

sami, to cover, to hide

samuta, burial, funereal proceedings;  tomb


samti the Book of Burials

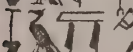
samw, to assemble

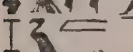

saw, to join, to unite to-

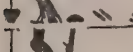

sama, to nourish, feed, a repast

sami, to combine, conspire

" samti, " "

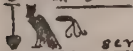

sem, to unite, to join, assemble, to shut


sem, " " " " "

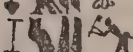

sem, hair, wool

" " "

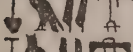
semi, a confederate, conspiring


semi, total darkness

semi, obscurity, fog

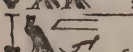

semenw, the thwart or seat of a boat

semenw, a bed or a bedstead, a sleeping mat


semt, an enclosure

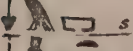
semt, establish

semta, burial, funeral


" " "

saw, a couch

saw, sunshine, a ray


sem, shade, shadow

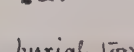
sem, the torture room

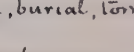
semti, a road, the way

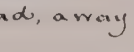
sem sutem, King's deputy, a chief

seminw, a part of a raiment

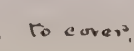
seb, sen


sew; a conch


sem sem xw, horses

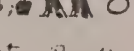

semtw, to combine, to assemble

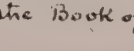
samtu, a kind of bread

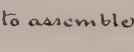

semta, burial

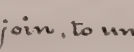
" "

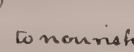
semit, a wife, a companion

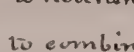

semui, obscurity, fog

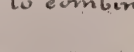
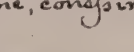

sem, burial

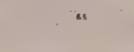

sennu, cakes, food

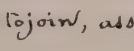

sotem, to hear, to listen


" " "

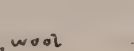

sotem, a day

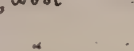

sotem, to hear, to listen; 

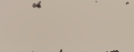

sotem nuw, to listen to mouths, i.e. to hear what is said

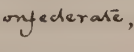

atat, ears

at, a kind of linen

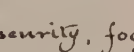

senetem, an office or title

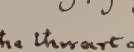

senetem " "

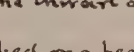

sotem to listen, to hear

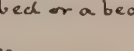

sotem " "

stem, stibium, antimony

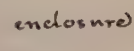

sen, a ploughshare, the coulter

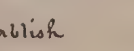

sotem an anta, ?

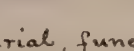

sotemen, a captain


sotemnw, chief, director, commander, leader

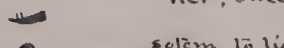
" " " " "

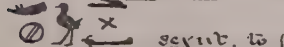

" " " " "


" " " " "

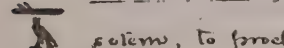

III sotem nu ta, a plant of which a conserve was made

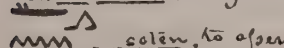
solēnw benarti, a confectioner, sweetmeat maker

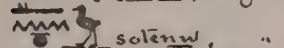

solēm, to listen, to hear


sexnit, to prepare

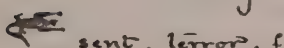
solēmnw, chief, leader, officer


solēm, to proclaim

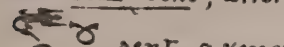

solēn, to open, to pass

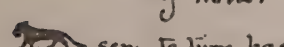

solēnw, " "

solēnnw, chief, directors, commanders, leaders, officers of cavalry

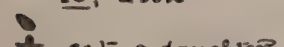

sent, terror, fear; Amen nēb sent Amon the lord of terror

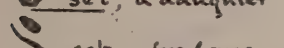
sent, terror, fear, timid, terrified

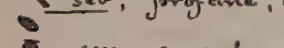

sent, a venerable appareil, a robe of honor


sen, to turn back

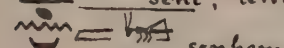
se, a son

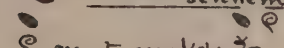

set, a daughter

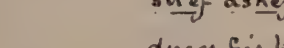

seb, profane, derided

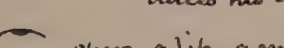

sen, second

sent, terror, terrified, fear

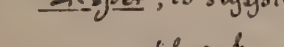

senhem, a grasshopper, locust


su, to make; su ef as hep ef em sati ef, he produces his light by his rays

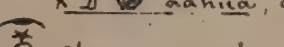

sper, a lip, a margin, a rib, a month

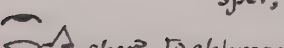

aaht, a moon, the month

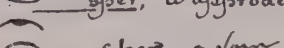
sper, to supplicate, to beg, to ask, to implore, humble prayer, to vow

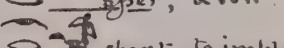

aahua, a substance, incense

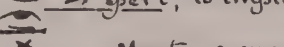
sper, a month

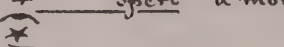

sper, to approach, reach arrive


sper, to approach, to reach, to arrive

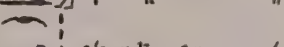

sper, a vow

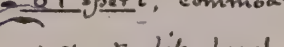

spert, to implore, supplicate, beg, pray, vow

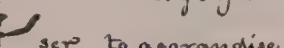

spert a month id:


" "

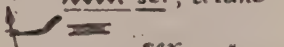
" "

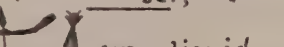

spert, commodity, provisions

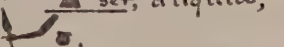

spert, lip, beach, bank of a river; her spert pa nw, on the edge of the water, on the beach

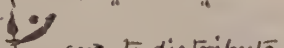

ser, to aggrandise, to enlarge, augment, to amplify, to render splendid, to extend (the hands), to dispose of, to organise, a measure of 4 palms or 16 fingers

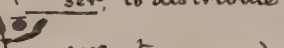
ser, a lake

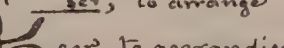

ser, "

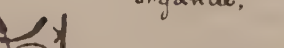

ser, a liquid, cream, or butter

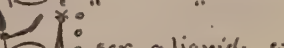

" " " " "

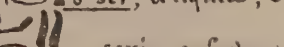

ser, to distribute, to choose

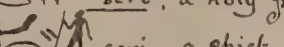

ser, to arrange

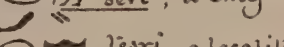

ser, to aggrandise, to enlarge, to augment, to amplify, to render splendid, to extend (the hands), to dispose of, to organise,

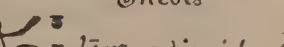

" " " " "


ser, a liquid, cream or butter


seri, a holy place, holy places

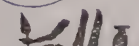

seri, a chief

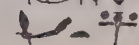

lēsri, a locality in the necropolis of Thebes

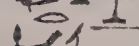

lser, a liquid, cream or butter

sert, " " "

ser, set


seri, a large jar, an amphora


sert, a table, a sideboard


sert, a liquid, cream or butter

" serti, " " "

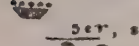
" serti nw " " "

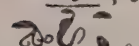
ušen, to draw, to engrave, to inscribe, to trace

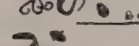
ser, since

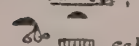
ser, chief, head, goddess

set, noisome


set, a stone


semw, grass, herb, fodder


sti, to dart rays of light, radiant, to light


sati, an arrow, to draw

sati, a sunbeam, a ray of light

sati, to shoot

sati, an archer

sat, to shoot

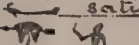
sat, grease

sati, to shoot arrows and darts

sti, dejection, desolation

sti, to ejaculate

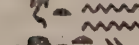
sti, a mythological serpent


sati ray, sunbeam

sati, to shoot

sat, to beam, connection

sati, to project, to spread, to diffuse


" " " " "

sati, a ray, a sunbeam

sti, when preceded by em sti, in front of.

salu, the sun's beams or rays

s

Ka, to punish

Kaw, weavers

shen, a brother

shennw, millions

Ka, a bushel, grain

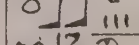
sa, fine, pure linen

III Kebeb, a spring

Kebw, copts, Egypt

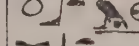
" Kebtā, " "

" Kebt, " "


I hebs mat, pure linen, a garment of Truth

" " " " " " "

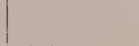
saar, an arrow


ser, an arrow

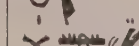
ser, a measuring cord

saar, an arrow

Kas, an arrow, alabaster


Kas, alabaster

Kasaw, a dart

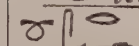

sasiw, arrows

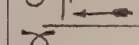
Kesem, a green stone

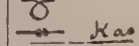
Kasow, jasper

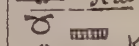
Keser, a cord, a line, (measuring)

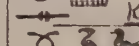
I Kesi, a measuring cord


ser, to stimulate


" " "

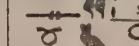

saaru, arrows


shenti, millions, attendants


sat, to lead, to bring

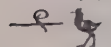
sati, " rusta, entrance of passage

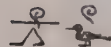
sta, excrement, copros

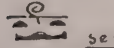

sti, a small cord

st, seteṗ

stai, a small cord


stu, a cord


stu, to fail, to grow faint, to want


seshtā, Amenti, the nether world

sab, a jackal

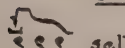
" sa, a son, to come, to become, to go

" shetā, an order of priests

tā shetā, the mysterious region, Amenti, the lower world, the tomb

seshtā mystēry;
her seshtā, over the mysteries, master of the mysteries, passed to the rank of a master

seteṗ, to choose, the chosen, approved


seteṗ, the thigh

at, an image, a form

at, colors, enamel

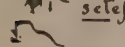
seteṗ, to cut off, to select, put apart

seteṗ, to adorn, to tie, choice cloth

seteṗ sa, to exercise protection, the power exhibited in "standing behind", as Isis protects Osiris standing behind him with outspread wings; a charitable pilgrimage

seteṗ sa, the palace, the court, the Pharaoh

seteṗ sa, a variant of
seteṗ her, approved by or for


seteṗ, choose, chosen, choice, approved, a cloth for the head

seteṗ, to walk, to go around

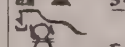
seteṗ, sxa

seteṗ heb, the 20th day of the month

seteṗ, to choose, to select, to approve

seteṗ t, a thigh

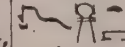
seteṗ t, to consume


seteṗ sa, Pharoah's palace, some royal act of distribution, perhaps an alms giving pilgrimage.

seteṗ sa, " " " " " "

setpu, an instrument, a mace, a paddle

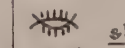
seteṗ nu, a bull,

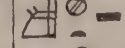

seteṗ sa t, the palace, the court, Pharoah

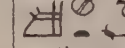
seteṗ, choice, chosen, approved

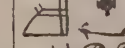
set, a sandbank

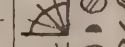
sti, cloth, a garment

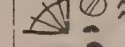

sti, " "

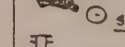

sxet, a pile of bricks, brick making

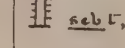

sxet, to weave


sxet her, was said of brick making

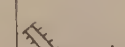

sexiii, to snare, to throw the net


sext, the inundation


set, a moment, instantaneous, sudden

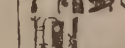

sebt, a wall;
ain su mak (anbu) sebt. it was protected by a wall

sebt hut, or anbu hut, a white wall, Memphis was so named after its white walls


ximw, to demolish, to pull down

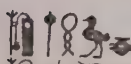
sutēn sxa, a royal military officer,

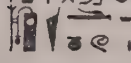
sutēn sxa, the King's scribe, royal scribe

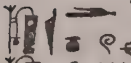

sxa, a painting

sxa nelēr tait, Scribe of the

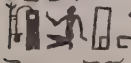
sacred books


sẖa ḥu w, scribe of the table


sẖa Kaṯenu w, scribe of the stone cutters or sculptors or builders


" " " " "

sẖa en- an accountant


sẖa em ṯa ṯeṗer, scribe of the temple

sesenu, eight, 8

T

Ṯut, a hand, give; it is also an abbreviated form of ṯaṯ to say, to speak

to give, to make do;

ṯaṯ en ef sẖuti ef em ḫpṯ, he gives his double plume on the head

ṯaṯ, to take

ṯaṯ, a gift

ṯi, to go along, direction, to remain, to stay, to stop

ṯaa, a kind of linen or clothes

ṯaṯ, glorified

ṯa, to take, to beat

ṯa, to pollute

ṯa, to beat

ṯa, the heavens, the sky

ṯa, to deploy, to extend

ṯa, a large garment

ṯaa, " "

ṯaa, to be impure, soiled

ṯaaru, murder, to beat, to lay low,

ṯaau, clothes, linen

ṯaauru, a sheath, a purse

ṯaaut, a hair covering, a rope, a cable

ṯaauu, slaughter, fray

ṯab, a fig;

" " ; id:

ṯeb, a mineral

ṯaba, a kind of game

ṯaṯi, a beat

ṯams, to grasp

ṯaṯu, to beat, to strike, to lay low, to be morally stricken, to constrain, to force

ṯan, to extend, to deploy, elongate

ṯan, to rise up, to go

ṯan, to rule over, to dominate

ṯan, to oppose, to resist, to rise up against, to rise and go, to lift up (the head)

ṯan, to rise up

" ṯani, certainly, surely

ṯan, to rise, to revolt

ṯaner, to extend, to deploy, to elongate

ṯabi, a bear

ṯeb, a medecine

ṯeb, figs, pomegranate

ṯeb, "

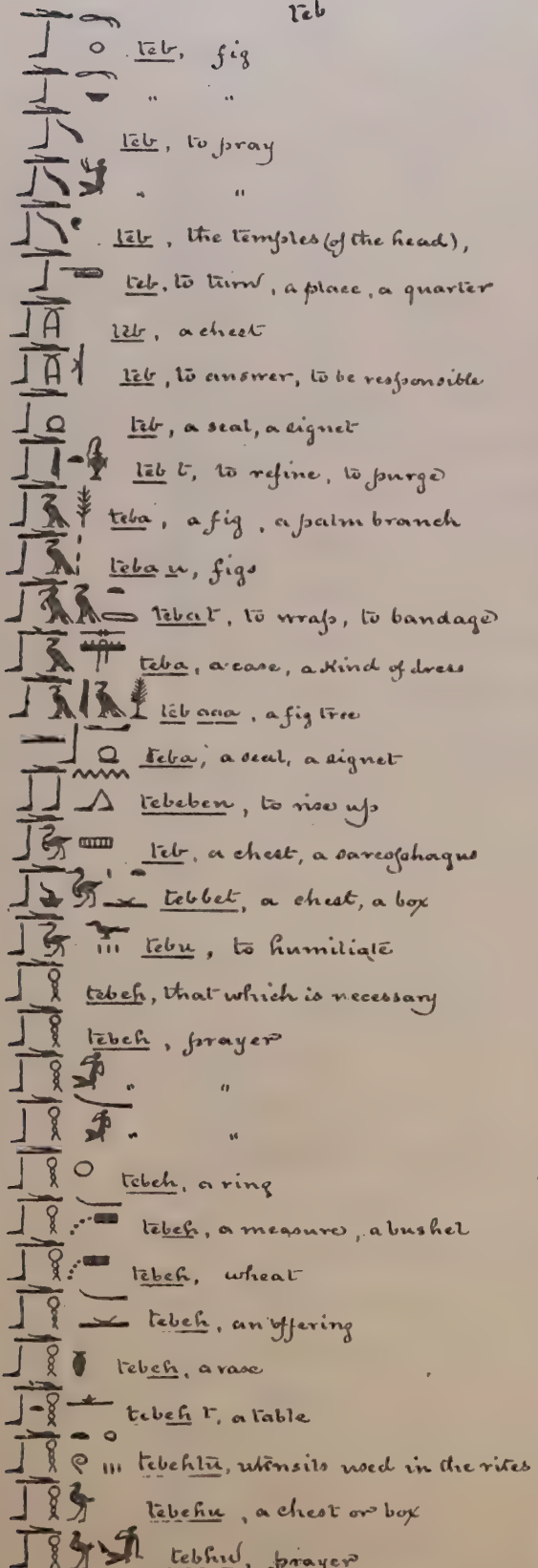
ṯeb, "

ṯeb, horned animals

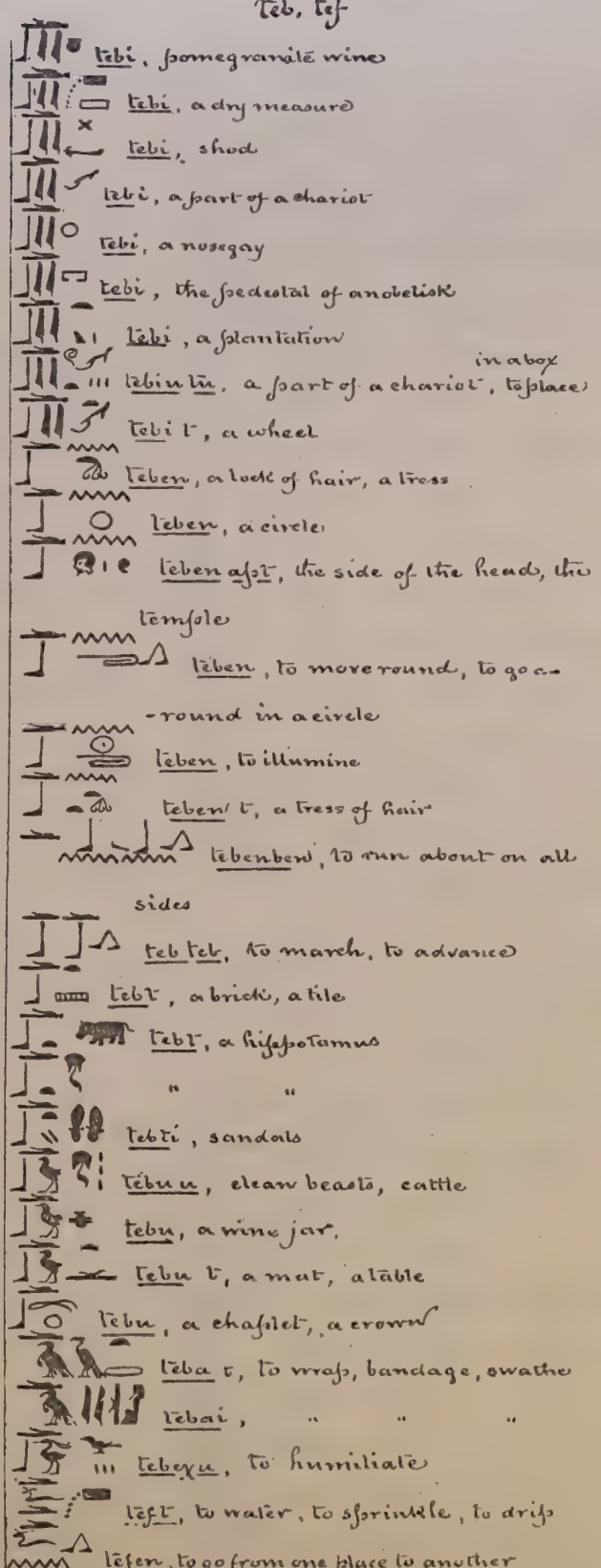
ṯeb, a brick, a tile, a weight, an ingot

ṯeb, a fig tree

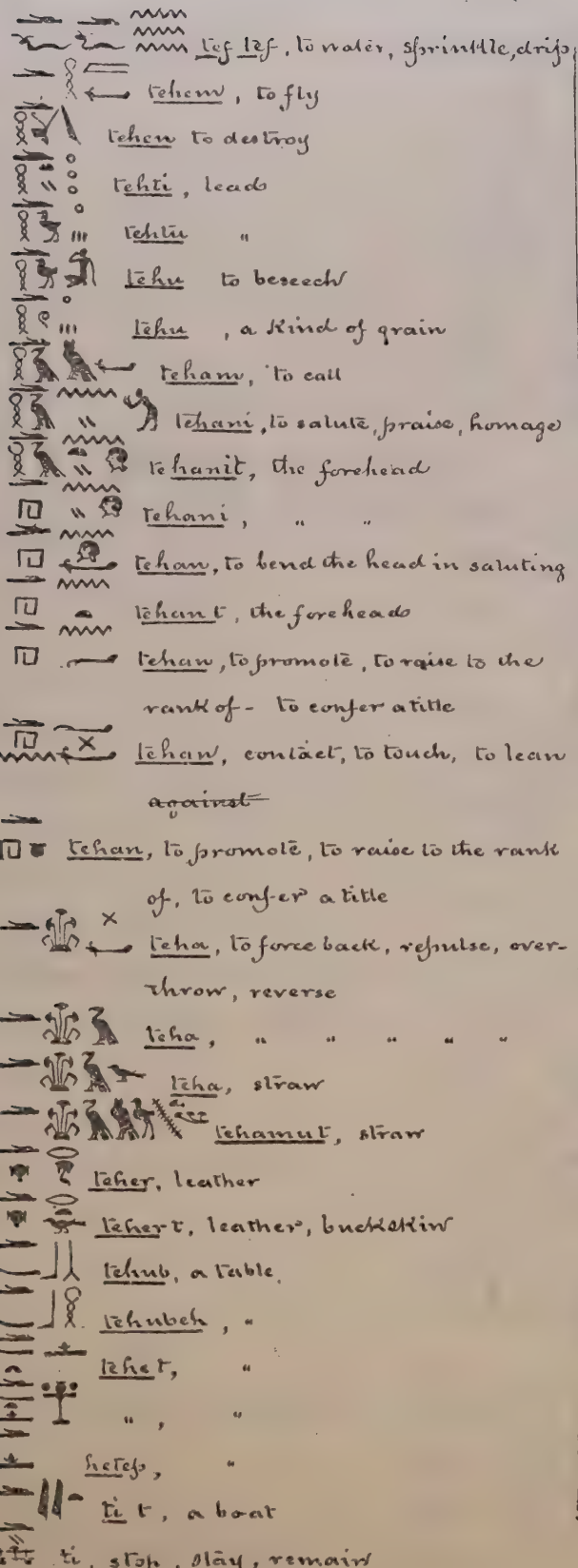
Teb


tēb, fig
" "
tēb, to pray
" "
tēb, the temples (of the head),
teb, to turn, a place, a quarter
tēb, a chest
tēb, to answer, to be responsible
tēb, a seal, a signet
tēb t, to refine, to purge
teba, a fig, a palm branch
teba w, figs
tebat, to wrap, to bandage
teba, a case, a kind of dress
tēb aaa, a fig tree
teba, a seal, a signet
tebeben, to rise up
tēb, a chest, a sarcophagus
tebbet, a chest, a box
tebu, to humiliate
tebeh, that which is necessary
tēbeh, prayer
" "
" "
tebeh, a ring
tēbeh, a measure, a bushel
tēbeh, wheat
tebeh, an offering
tebeh, a vase
tebeh t, a table
tebehtū, utensils used in the rites
tēbehu, a chest or box
tebhui, prayer

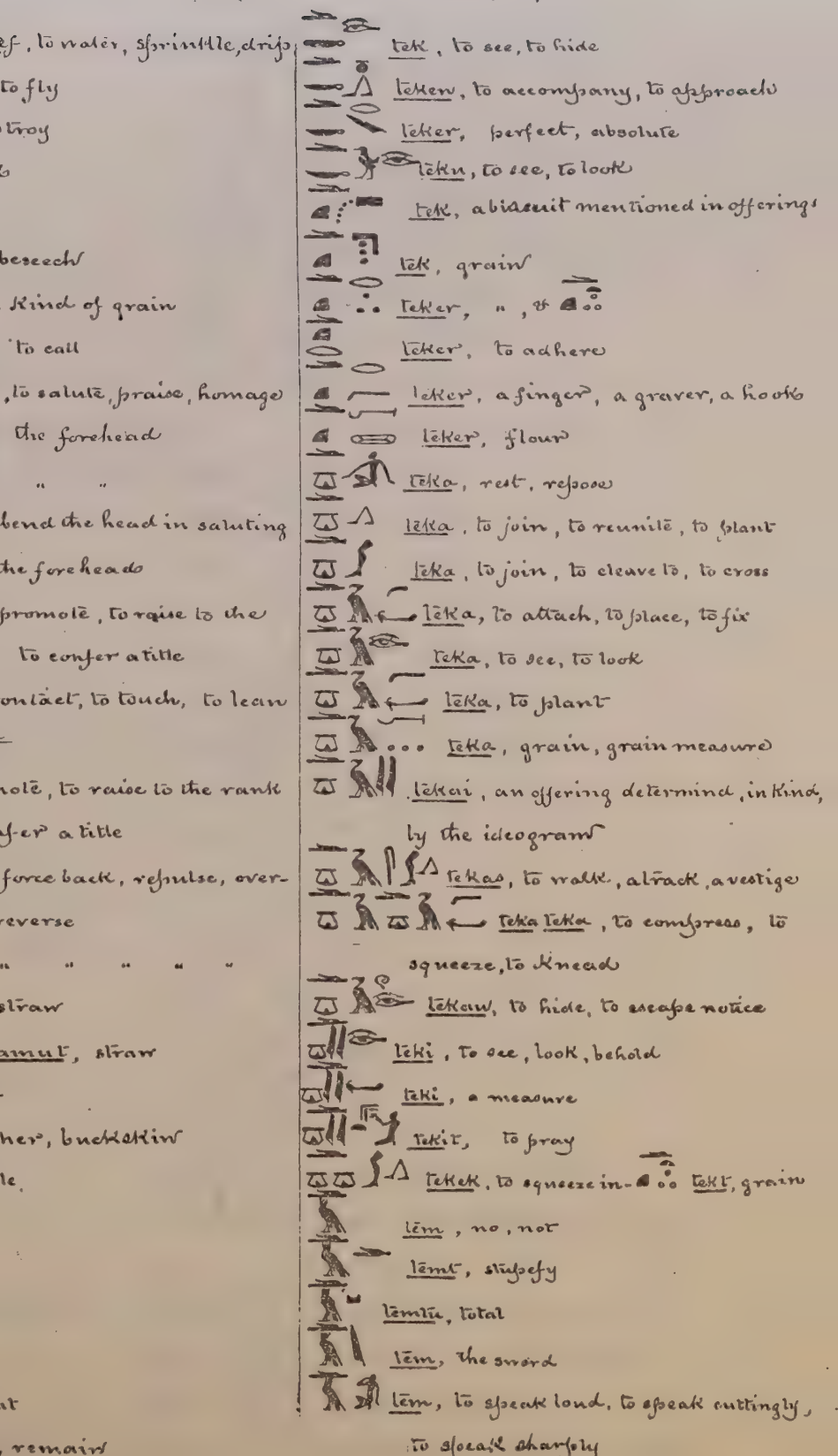
Teb, tef

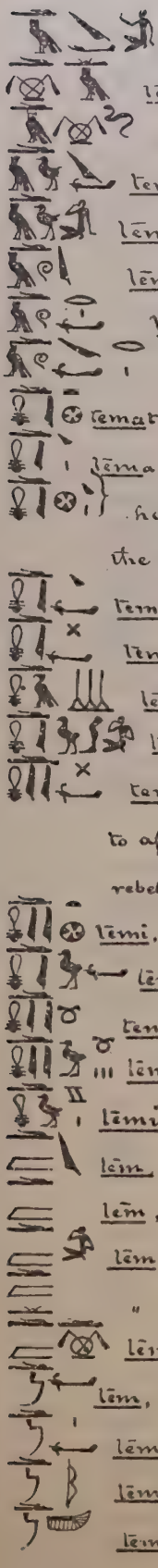

tebi, pomegranate wine
tebi, a dry measure
tebi, shod
tebi, a part of a chariot
tebi, a nosegay
tebi, the pedestal of an obelisk
tēbi, a plantation
tebiu tū, a part of a chariot, to place in a box
tebi t, a wheel
tēben, a lock of hair, a tress
tēben, a circle
tēben afet, the side of the heads, the temple
tēben, to move round, to go a-round in a circle
tēben, to illumine
teben t, a tress of hair
tebenbew, to run about on all sides
teb teb, to march, to advance
tebt, a brick, a tile
tebt, a hippopotamus
" "
tebti, sandals
tēbu w, clean beasts, cattle
tebu, a wine jar
tebu t, a mat, a table
tēbu, a chaplet, a crown
tēba t, to wrap, bandage, swathe
tebai, " " "
tebexu, to humiliate
tēft, to water, to sprinkle, to drip
tēfen, to go from one place to another

Teh, ti


Tef Tef, to water, sprinkle, drip
Tehem, to fly
Tehen to destroy
Tehti, lead
Tehtu "
Tehu to beseech
Tehu, a kind of grain
Tehaw, to call
Tehani, to salute, praise, homage
Tehanit, the forehead
Tehani, " "
Tehaw, to bend the head in saluting
Tehant, the forehead
Tehaw, to promote, to raise to the rank of - to confer a title
Tehaw, contact, to touch, to lean against
Tehan, to promote, to raise to the rank of, to confer a title
Teha, to force back, repulse, overthrow, reverse
Teha, " " " " "
Teha, straw
Tehamut, straw
Teher, leather
Tehert, leathern, buckskin
Tehub, a table
Tehubeh, "
Tehet, "
" "
Herep, "
Tit, a boat
ti, step, stay, remain

Tek, tem


Tek, to see, to hide
Tekem, to accompany, to approach
Teker, perfect, absolute
Tekn, to see, to look
Tek, a biscuit mentioned in offerings
Tek, grain
Teker, " ,
Teker, to adhere
Teker, a finger, a graver, a hook
Teker, flour
Teka, rest, repose
Teka, to join, to reunite, to plant
Teka, to join, to cleave to, to cross
Teka, to attach, to place, to fix
Teka, to see, to look
Teka, to plant
Teka, grain, grain measure
Tekai, an offering determined, in kind, by the ideogram
Tekas, to walk, attack, a vestige
Teka Teka, to compress, to squeeze, to knead
Tekaw, to hide, to escape notice
Teki, to see, look, behold
Teki, a measure
Tekit, to pray
Tekek, to squeeze in-
Tekt, grain
tem, no, not
temt, stupefy
temtu, total
tem, the sword
tem, to speak loud, to speak cuttingly, to speak sharply



lēnu, to proclaim

lēmt, totāl

lēmt "

lemnu, to sharpen

lēmw, to pronounce

lēmu, to cut to pieces

lēmu nu, to be dumb; silent

" " " "

lemat, a city, place, village, stronghold

lēma, a city, a village, a place, a stronghold; lēma en nut, the city; a city, watering place

lema, to approach

lēma, to unite

lēma, linen cloth

lēmu, to restore, to approach

lemi, to meet, to unite, approach, to approximate, to join, confederate; rebels do lēmai, assemble

lēmi, a city, a place, a stronghold

lēmau, to meet, unite, approach

lemi, a kind of linen, a hank, twist

lēmiu, bands

lēmu, a fort

lēm, a sword, the sword

lēm, to cut

lēm, to announce

" "

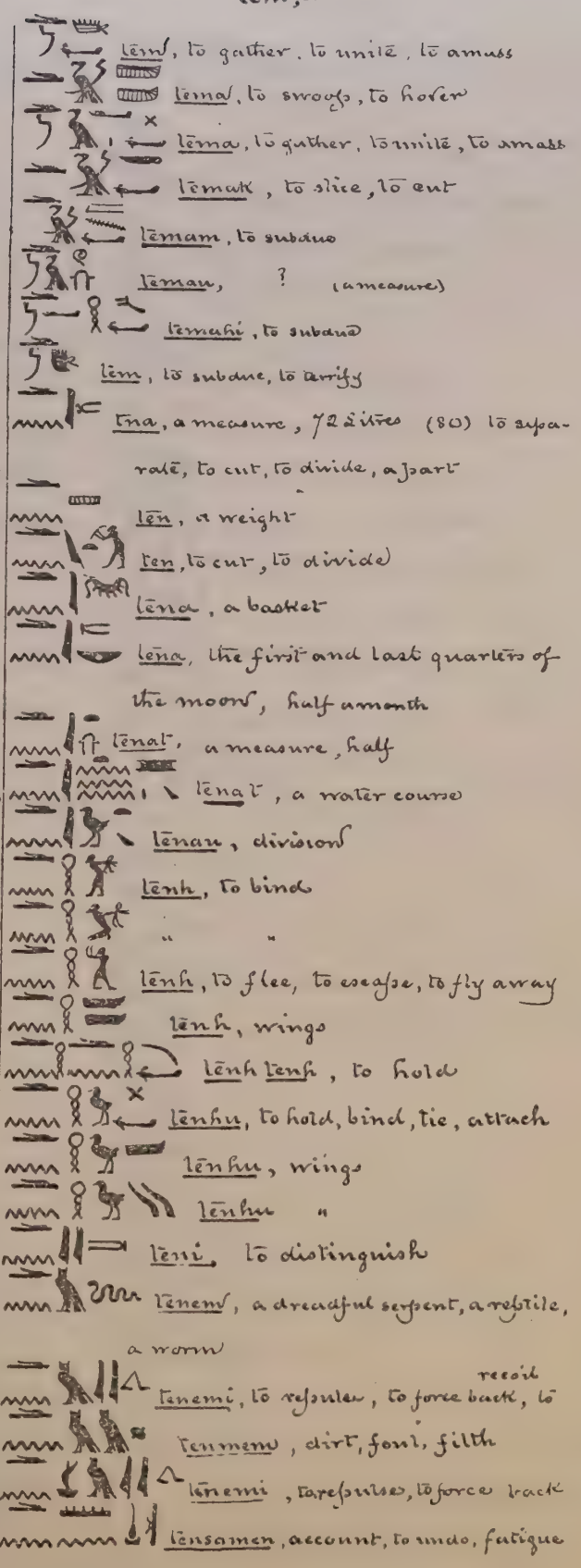
lēmt, the totāl

lēm, to sweep, to terrify, to subdue

lēm, " " "

lēm, to shoot

lēm, a wing, to fly, to soar



lēw, to gather, to unite, to amass

lēwa, to sweep, to hover

lēma, to gather, to unite, to amass

lēmakk, to slice, to cut

lēmam, to subdue

lēmau, ? (a measure)

lēmahi, to subdue

lēm, to subdue, to terrify

lna, a measure, 72 litres (80) to separate, to cut, to divide, apart

lēn, a weight

len, to cut, to divide

lēna, a basket

lena, the first and last quarters of the moon, half a month

lēnat, a measure, half

lēnat, a water course

lēnau, divisions

lēnh, to bind

" "

lēnh, to flee, to escape, to fly away

lēnh, wings

lēnh lēnh, to hold

lēnhu, to hold, bind, tie, attach

lēnhu, wings

lēnhu "

lēni, to distinguish

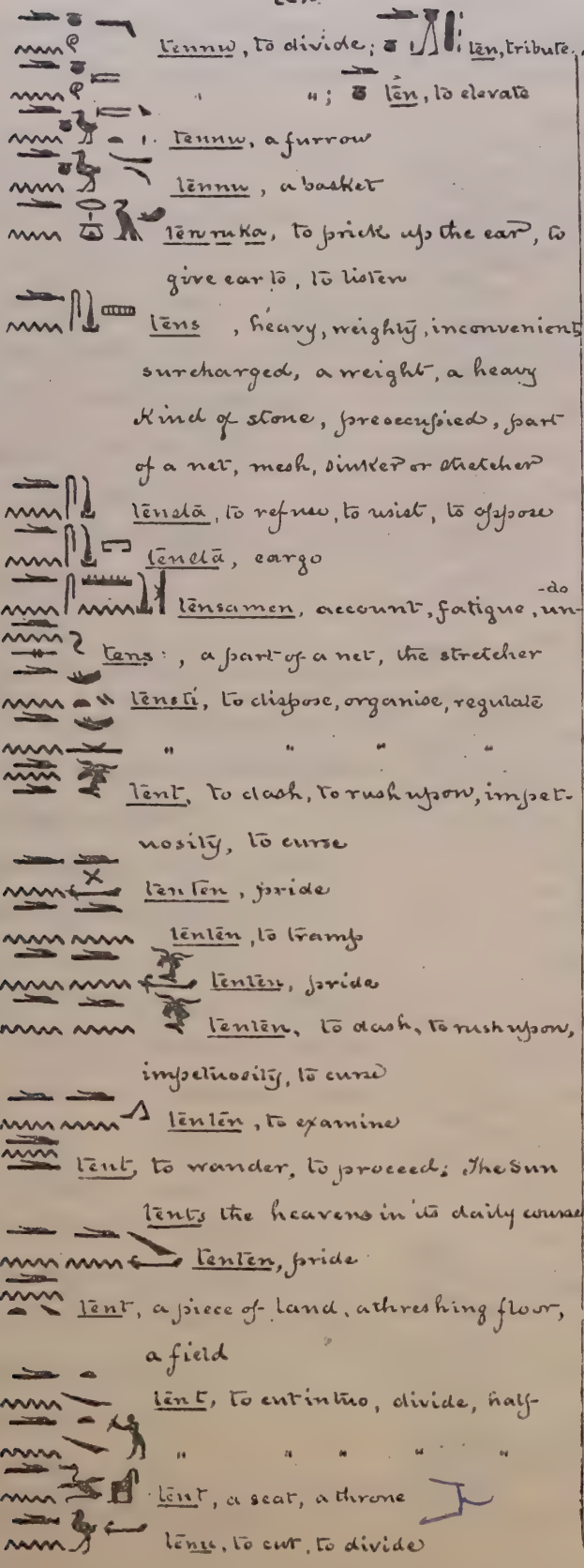
lēnew, a dreadful serpent, a reptile, a worm

lenemi, to repulse, to force back, to receive

lenmew, dirt, foul, filth

lēnemi, to repulse, to force back

lēnsamen, account, to undo, fatigue



tēnnw, to divide; tēn, tribute

" "; tēn, to elevate

tennw, a furrow

tēnnw, a basket

tēnmka, to prick up the ear, to give ear to, to listen

tēns, heavy, weighty, inconvenient, surcharged, a weight, a heavy kind of stone, preoccupied, part of a net, mesh, sinker or stretcher

tēnetā, to refuse, to resist, to oppose

tēnetā, cargo

tēnsamen, account, fatigue, -do un-

tens, a part of a net, the stretcher

tēnsti, to dispose, organise, regulate

" " " "

tēnt, to clash, to rush upon, impetuosity, to curse

tēntēn, pride

tēntēn, to tramp

tēntēn, pride

tēntēn, to clash, to rush upon, impetuosity, to curse

tēntēn, to examine

tēnt, to wander, to proceed; the Sun tents the heavens in its daily course

tēntēn, pride

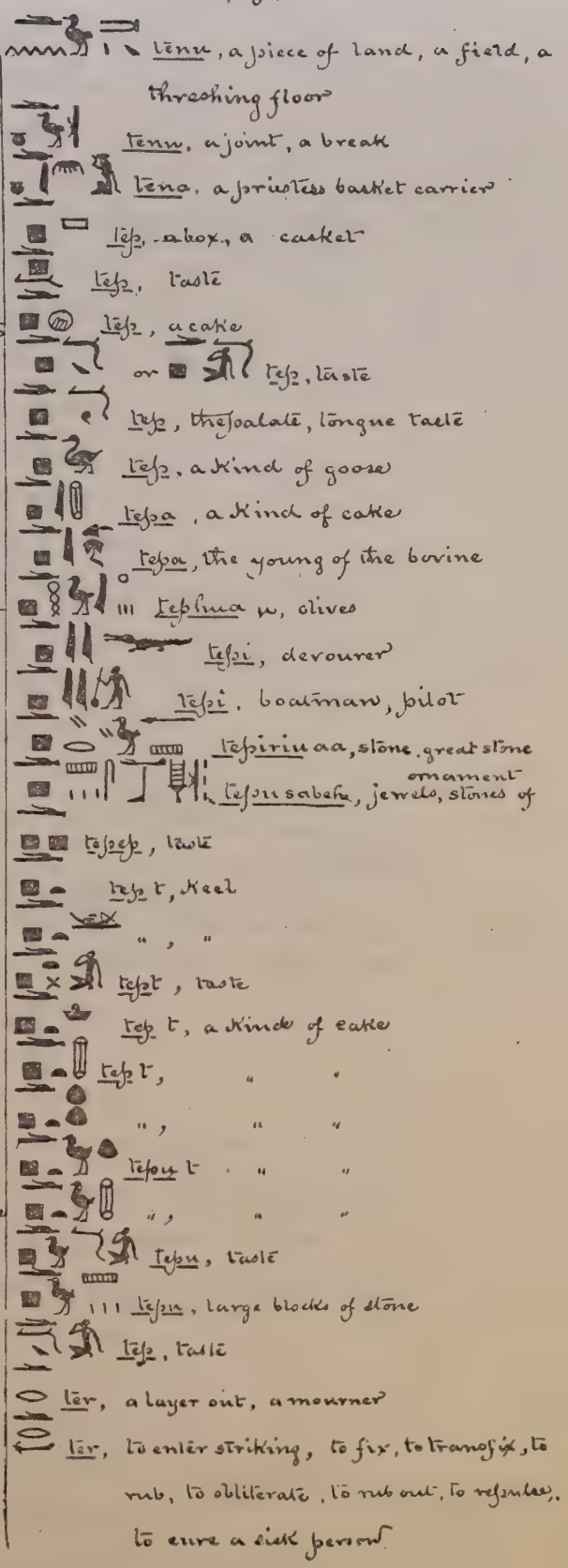
tēnt, a piece of land, a threshing floor, a field

tēnt, to entwine, divide, half-

" " " " "

tēnt, a seat, a throne

tēnṯ, to cut, to divide



tēnw, a piece of land, a field, a threshing floor

tēnw, a joint, a break

tēna, a priestess basket carrier

tēsh, a box, a casket

tēsh, taste

tēsh, a cake

or tesh, taste

tēsh, the sole of the foot, tongue taste

tēsh, a kind of goose

tēsha, a kind of cake

tesha, the young of the bovine

tēshwa w, olives

tēshi, devourer

tēshi, boatman, pilot

tēshiriw aa, stone, great stone

tēshw sabeh, jewels, stones of ornament

tēshesh, taste

tēsht, keel

" "

tēsht, taste

tēsht, a kind of cake

tēsht, " "

" " "

tēshwt " "

" " "

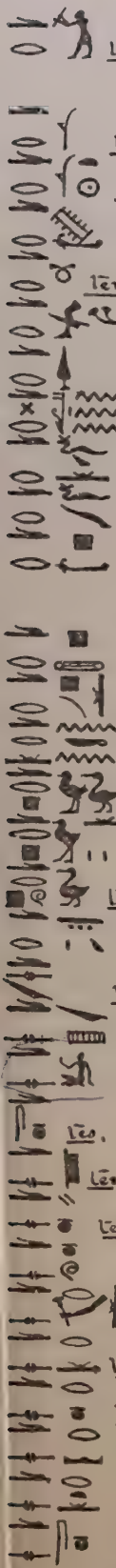
tēshw, taste

tēshw, large blocks of stone

tēsh, taste

tēr, a layer out, a mourner

tēr, to enter striking, to fix, to transfix, to rub, to obliterate, to rub out, to resemble, to cure a sick person



ḫēr, to chase away, to knock, to drive, to slay, to beat, to lay low

ḫēr, " " " " "

ḫēr t, " " " " "

ḫēr, to demolish, to injure

ḫēr, stuff, cloth, fine cloth

ḫēr, a plant used in dyeing

ḫēr, a flower garden, a flower pot

ḫēr, to wash, to purify

ḫērer, a sacred book

ḫērf, sport, lively

ḫērp, to choose, to offer, to make an offering

ḫērp, food

ḫērḫ, the rites of Thoth, literature

ḫērneker, a plant used in dyeing

ḫērpen, a goose, or a kind of duck

ḫērpen w, food

ḫērpen, a goose or a kind of duck

ḫēr ta, to travel, to go to a place

ḫēs, a weapon, to cut

ḫēs, a hard stone, dense, thick, hard

ḫēs, to sit down, to take a place

ḫēs, a bottle, a liquid measure, a crock

ḫēs, a gate

ḫēsi, a liquid measure

ḫēsen, a liquid, a bottle

ḫēser, to arrange, prepare, to clean

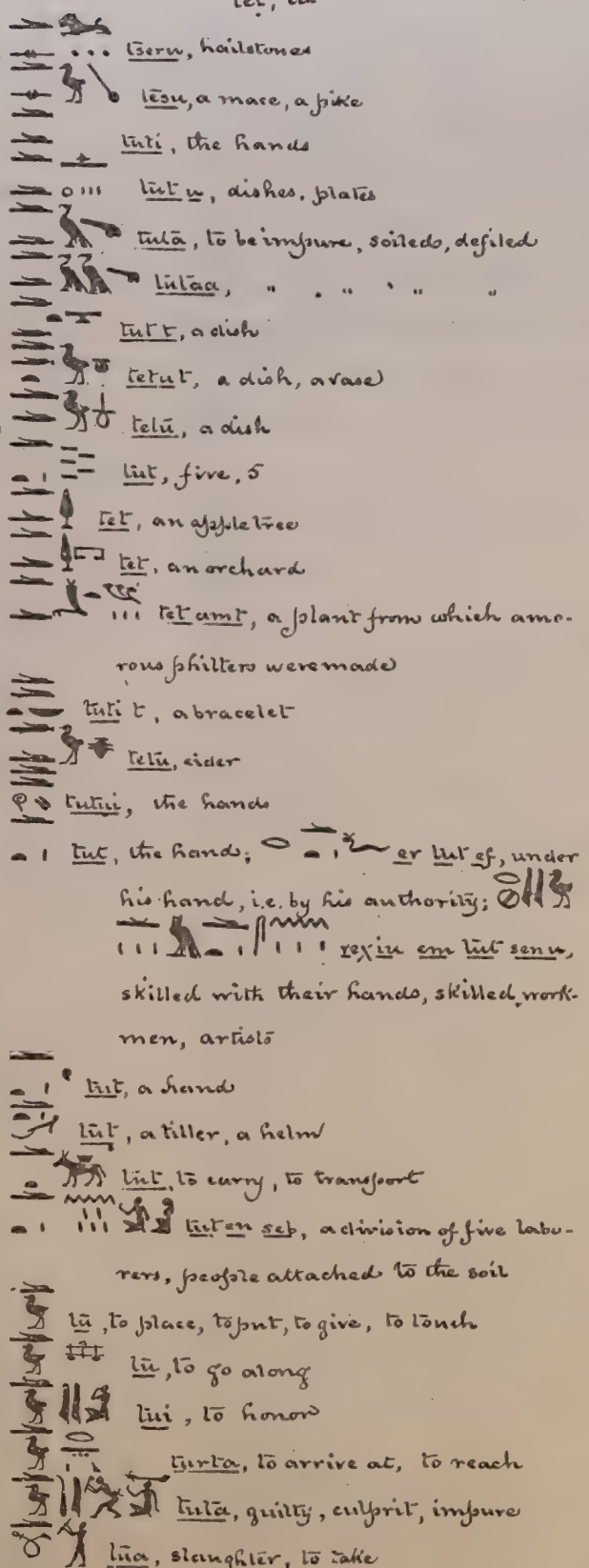
ḫēser, to prepare, to command, supply

ḫēser, a liquid measure

ḫēser, a rock

ḫēsert, a ruler

ḫēses, a liquid quantity



ḫērw, hailstones

ḫēsu, a mace, a pike

ḫuti, the hands

ḫutw, dishes, plates

ḫutā, to be impure, soiled, defiled

ḫutāa, " " " " "

ḫutt, a dish

ḫetut, a dish, a vase

ḫetū, a dish

ḫut, five, 5

ḫet, an apple tree

ḫet, an orchard

ḫetamt, a plant from which amorous philters were made

ḫuti t, a bracelet

ḫetū, cider

ḫutui, the hands

ḫut, the hands; er ḫut f, under his hand, i.e. by his authority; rexiu em ḫut sen w, skilled with their hands, skilled workmen, artists

ḫut, a hand

ḫut, a tiller, a helm

ḫut, to carry, to transport

ḫut en seb, a division of five laborers, people attached to the soil

ḫū, to place, to put, to give, to touch

ḫū, to go along

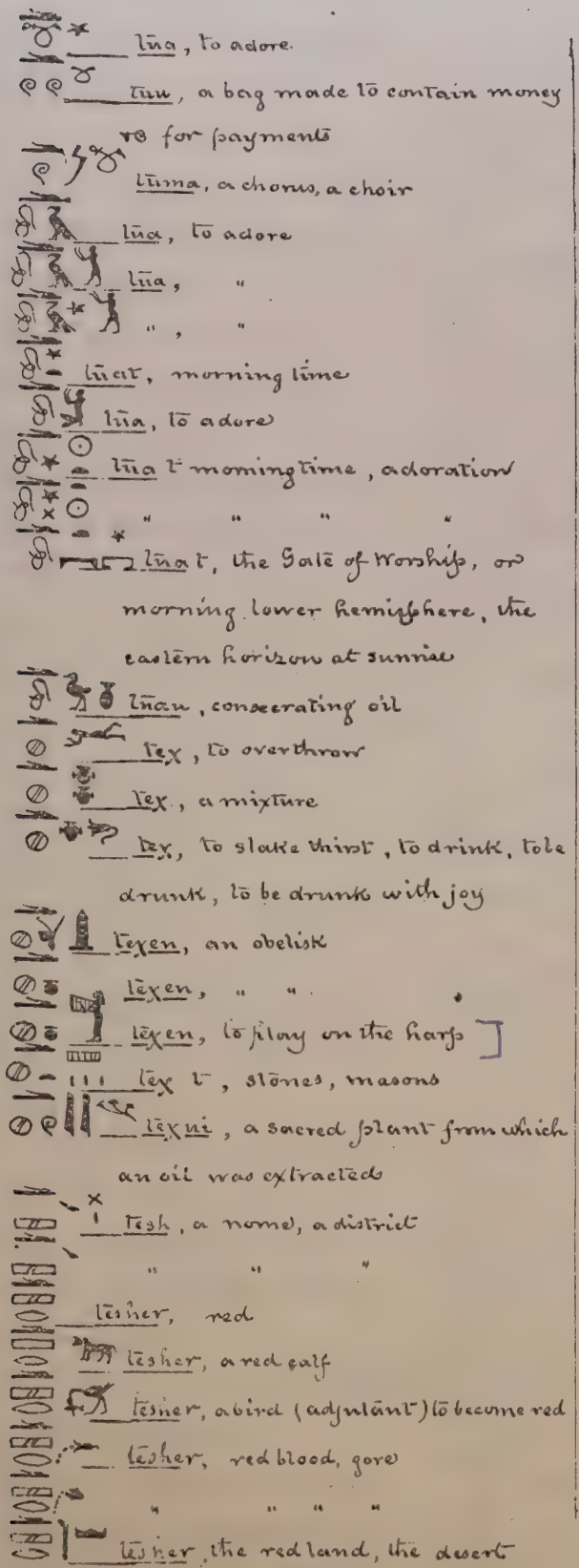
ḫui, to honor

ḫirta, to arrive at, to reach

ḫutā, guilty, culprit, impure

ḫuā, slaughter, to take

lū, lex, lesh



lūa, to adore

lūw, a bag made to contain money or for payments

lūma, a chorus, a choir

lūa, to adore

lūa, "

" , "

lūar, morning time

lūa, to adore

lūa t morning time, adoration

" " " "

lūa t, the Gate of Worship, or morning lower hemisphere, the eastern horizon at sunrise

lūau, consecrating oil

lex, to overthrow

lex, a mixture

lex, to slake thirst, to drink, to be drunk, to be drunk with joy

lexen, an obelisk

lexen, " "

lexen, to play on the harp

lex t, stones, masons

lexni, a sacred plant from which an oil was extracted

lesh, a nome, a district

" " "

lesher, red

lesher, a red calf

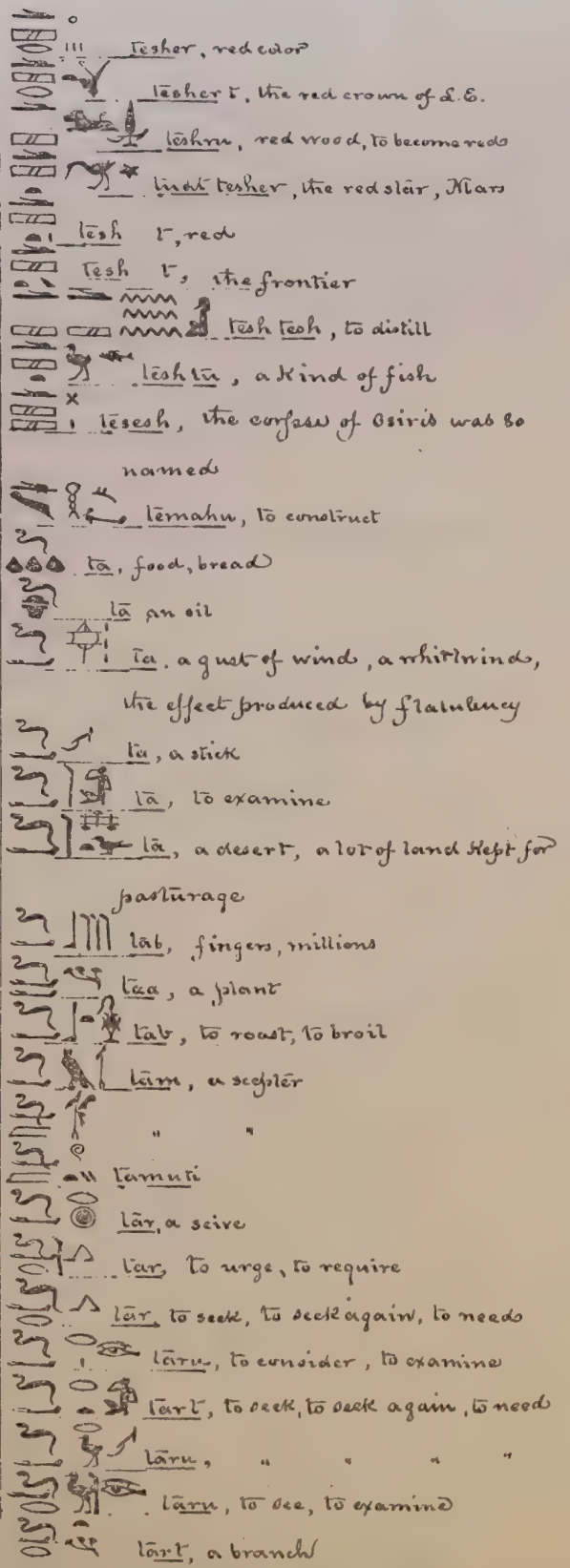
lesher, a bird (adjutant) to become red

lesher, red blood, gore

" " " "

lesher, the red land, the desert

lesh, ta



lesher, red color

lesher t, the red crown of L.E.

leshru, red wood, to become red

hnet lesher, the red star, Mars

lesh t, red

lesh t, the frontier

lesh leah, to distill

leshtu, a kind of fish

lesesh, the corpse of Osiris was so named

lemahu, to construct

ta, food, bread

la an oil

ta, a gust of wind, a whirlwind, the effect produced by flatulency

tu, a stick

ta, to examine

ta, a desert, a lot of land kept for pasturage

tab, fingers, millions

taa, a plant

tab, to roast, to broil

tam, a sceptre

" "

tamuti

tar, a seive

tar, to urge, to require

tar, to seek, to seek again, to need

taru, to consider, to examine

tart, to seek, to seek again, to need

taru, " " " "

tarru, to see, to examine

tart, a branch

tabu, to cook, to burn

tābū u, winds

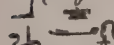
tata nu, to knock at the door

tba, an ingredient of the Kyphi

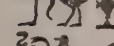
teba t, to seal, to close, to shut

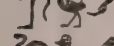
tab, a finger

teba, a seal, to seal


tebat, to roast, to cook

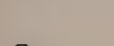
tebu, " "


tebu, a carriage, carriage seat

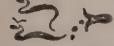

tebu, to transcend, to elevate, to extol

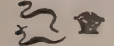
tēba, an odoriferous wood

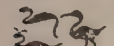
tef, the Kyphi, a perfume composed of sixteen ingredients, fragrance

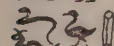

tef, the pupil of the eye

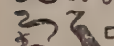
tef, a drop of -


tef, grain


tef, food, subsistence, offerings


" " " "


tefa, a granary, a storehouse


tefa, provision, subsistence, food

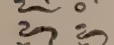
tēf, a tree

tefen, generator, parent, father

tefen, to rejoice

tefet, the pupil of the eye

tef tēf, dew, damp, humidity


tef t, an oven

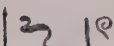
tēh, speech, address; tekn, a gift, present

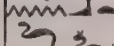
tehr, lead, (plumbum)

temo, a bird, avicella recurrirostra

tēn, to turn aside from a road, avoid

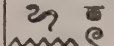
tēn, the cranium, the upper part of the head

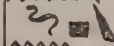

tēnbut, bowlegged

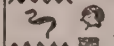

tēnef, father, ancestor, generator

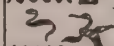
ten hut, something connected with a steersman

tēnen, the cranium, the upper part of the head


tennut, a footpath


tēnf, a rudder, a tiller


tēnaf, ancestor


tenia, a temple built within another

tēr, a crown

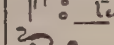
tēraa ?

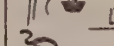
tēs, self; tēsa, myself; tēsek, thyself; tēsef, himself

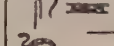
tēs, he

tes, ?

tes, food


tes, deep, depth

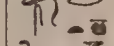

tēs, a joint

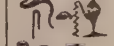

teser t, a liquid, cream or cheese, a jar tē

" " " " "

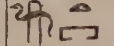
teser t " " " "

test " " " "


tes, cheese, butter


tes, a paddock, a stable

tē, an oil

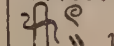

tē, abyss, gulf, depth, to plunge

tet, " " " "

tetu, " " " "

tun, " " " "

ti, " " " "


tut, a precipice 100 ells high

ṯeṯ

ṯes, free, self, ṯesa, myself

ṯesef, himself, mnkṯesa, I myself

ṯeses, herself,

ṯesfu u, to catch in a net

ṯeser t, secret, sacred, reserved

ṯeser, organisation, period; em ṯeser Abw, from the time Abydos was founded

ṯeser t, cheese or butter

" " "

ṯut, speak, words, in fact, because, say; em ṯut, speaking; er ṯaṯ, that is to say; ṯaṯu u em wiu u aru u, they said between them, i.e. they said to one another; ṯut ḥna ṯut, word with word, a series of orders, directions

ṯaṯ, words, language, speak, tell, said

ṯeṯ, to roast, to cook

ṯeṯbi, the one who stings, wounds, a serpent

ṯeṯbu, to wound, to sting

ṯeṯbu to cook, to burn

ṯeṯef, stiff

ṯeṯef, a serpent

ṯeṯf, an instrument used to open the mouth of the dead, in the ceremony of the Apru, in Amenti

ṯuṯfi, a reptile

ṯuṯef ṯ, "

ṯuṯef ṯ, a dagger

ṯeṯ

ṯuṯiṯu, a proclamation, acclamation

ṯeṯw, to contain, to imprison

ṯeṯw, a prison, a tomb

ṯeṯ, seed, fruit or olives

ṯeṯeṯu, canal, bay

ṯeṯek ḥati, worry, anxiety, care

ṯeṯmer, fruit, quantity of fruit

ṯeṯem, a hillock, a mound, a pile, a fist full

ṯeṯmet, a tress, a sheaf

ṯeṯem, a string

ṯeṯem, a hillock, a mound, a pile, a fist full.

ṯeṯna, stuff, garment

ṯeṯsu, a steering oar

ṯeṯeṯ, bread or cakes

ṯeṯuḳ, grain, seeds

ṯeṯw, olive tree, olive oil

III ṯeṯu u, olives

ṯeṯu ṯ, to sing

ṯeṯā, eternal, eternity

ṯeṯ, son child

ṯeṯ, say, speak, spoke, said

ṯeṯ, oil

ṯeṯ, a phallus

ṯeṯ, people belonging to the soil, peasants

ṯeṯ, to generate, to breed, to procreate, essence, being, nature

ṯeṯ en renpit, an ingredient of the Kyphi

ṯeṯ, depth

ṯeṯ, eternal abode, the lower world, the tomb

ṯeṯ, papyrus

ṯeṯ, fire, to cook

ṯeṯ, fire

ṯeṯ, oil

ṯeṯ, olives, olive oil

ṯeṯ, the block, to decapitate

ṯeṯ, ?

ṯeṯ, olive tree

ṯeṯ, unction, tongue, body, mouth

ṯeṯ ṯeṯā, body eternal, the mummy

ṯeṯā, eternally

" "

" "

ṯeṯ, the body

" " "

ṯeṯā, servants, domestics

ṯeṯā, eternally

ṯū, cattle.

ṯī forms the participle in the same way ṯā does; It is also a causative ab anχa, living;

ṯi, to carry off, take, conduct, lead, march, walk; ṯi ṯser ṯāi, conqueror, leader, of the two regions (title of Amenemhat Ier)

ṯi " " " " " "

ṯā, a soldier

ṯāṯā, to gallop

ṯau, followed by sheṯ, to take counsel

ṯab, the standard weight of an ox

ṯau, to gallop

ṯaṯā, " "

ṯeb, a box

ṯeb, figs

ṯeb a sandal, the sole of the foot

ṯeb, ṯeb, to fall, to roll

ṯeb, a cage

ṯebeh, Typhon

ṯeben, to turn, to walk in a circle

ṯeb, ajng, a jar

ṯeb, a lock of hair

ṯebu, a jar

ṯebu, a measure

ṯebu ṯ sandals

ṯebṯ, a sistrum

ṯef, to tumble

ṯef ṯef, to water, to sprinkle

ṯehi the throat

or ṯehekuṯ, to rejoice

ṯehi, to take

ṯehen, glass or clear quartz

ṯehen, to fly, to meet

ṯehen, crystal

ṯehennu, an aromatic oil

ṯehs, to stretch

ṯehs, to work in leather

ṯehu, to fell

ṯeher, to go towards, to approach

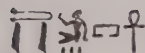
ṯehu, an artisan

ṯeheh, to rejoice

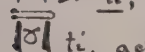
ṯehen, to approach a woman (of)

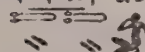
ṯehaṯ, to deprive, to take away

tch, tem, ten


ti augeri any- sacred scribes. the title of a high functionary in the Vth dynasty

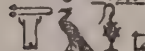
ti, a writer

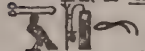

ti, a cloth, a wrap, a bandage

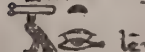

titi, to groan, to stammer

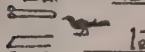
tchom, to cry out, to yell

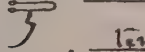
tek t, bread

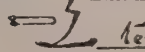

teka, a spark

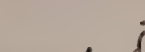

tēm, a ticket

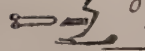

tēm t, to spy, to covet

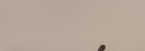

tēm, no, not, without


tēm, to vanquish, to soar, the Horus punisher,


témas, to vanquish, to soar, to make just, visible

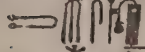

téma, The punisher, a name of Horus

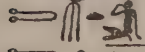

téma, The punisher, to make tēm, just,


tēmes, a board

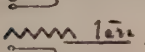
tēmes, a blot

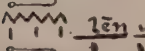
témes, to rear a child

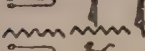

tēmeh u, the men of the North


tēn, the, this, ye, yours

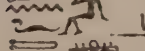
tēn u, ye, yours

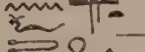

tēnanaw, prudent, reserved

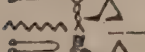

tēnef, a dancer

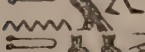

tēnef, a title, descendent, sport, jest

tēnef t, stuff, cloth, bag, cushion


tēneh, to fly, to flee

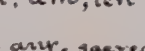

tēnenw, recoil

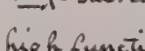

ténmend, to make cry

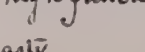

tenemi, to force back, to repulse

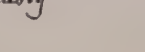
tēni teni, revolt, pride

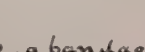
ten, tep

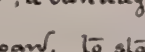

tenent, a throne, a cabinet

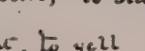

tennw, amount, each, every

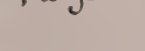

tēnnw, amount of weight, as a


tēn, r tēn

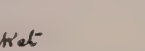

tēnnu, to reckon, how, when, where


tēnnw, amount

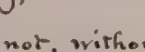

tēnnu t, each, every

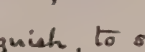

ten to distinguish

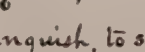
tēns, Typhon, Vulgar, rude, fierce

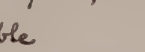

tēntēn, revolt, pride

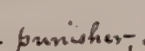
ten tēn, to hesitate, to vacillate, to totter, to finish


tēnt, reckoning, each, every


ten t, reckoning, amount, number

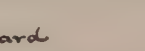

tēn t, reckoning, each, every

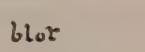

tenti, a temple built within another


tēnen, a parlor, dining room, a throne room

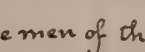
tēp, a goose

"


tēpshw, a gate, a valve


tēr ret. w, all people

ter, fine stuff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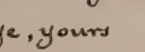
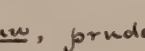
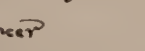
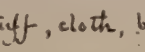

tēra, time, season

terf, a dancer


t'rim, to make cry


tērpa, a goose

"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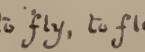

tērpu, to walk, as a goose does, poising oneself

tērri, a small rising ground, a bank

ḥēs

ḥēr-ḥēr, a small rising ground, a bank

ḥeru, time

ḥēs, a tied up roll

ḥēs, suspend, elevate, bind, transport

ḥēs, an ornament of dress

ḥēs, a piece of cloth, to stretch

ḥes, to rise, to mount

ḥēs, the sky, the heavens

ḥēs, a tooth

ḥēs, to carry, to bear, to raise

ḥēs, to support, to prop

ḥesas, lord, master, the name of the seven genii of the ritual

ḥesa, guide

ḥesi, to mount, rise, marvel

ḥesi, food

ḥesem, a dog

ḥēsmu, a lion-cat or grey hounds

ḥesem, a bastion, a fortification

ḥesem, a dog or grey hounds

" " "

ḥesem t, " "

ḥēsem, " "

" " "

ḥēsem t, the banks of a river or of a basin; stone work lining the waters edge

ḥēs, pride

ḥēs ḥati, high hearted, vain, proud

ḥēsi, high land, mountain

ḥēs, to wrap around, to bandage, a knot

ḥet

ḥēsḥēs, an ointment made with fine oil

ḥes ḥēs, clothes, wraps, bandages, to swathe

ḥesi, the beak of a bird

ḥet, a table, a couch

ḥet, a scribe, a writer

ḥāi, to pillage, steal, carry off, misap-propriate, drag.

em ti ḥati a em ḫeru ek, let me my heart be carried away by thy words.

ḥet, a book, a writing

ḥet, a bird

ḥet, a table, an altar for offerings

ḥēb t, a sandal

ḥet, take, assume

ḥeref, to distil, to drop, a drop

ḥeref, to shake, to mount

ḥeref, to disperse

ḥēḥef, to pour, inundation

" " "

ḥeḥef ḥū, libations

ḥet ma, to do justice, to distribute

ḥep t, a duck or goose

ti ḥait enti peranx, a writer of the holy books, a sacred scribe

ḥetḥet, to speak, to discourse, talk, to chatter, to talk much

ḥeṯu, to pass through

ḥuaa, to take

ḥuf papyrus

ḥuf, papyrus, fodder, reeds

tiut, tem, tā

tutie, a sparrow

tiutī, "

tuparu, a drum, a tambourine

turutā, a cereal

tutū, a sparrow

tuta, "

tex. to repress, to put down

tex tex. to repress, to put down

tesh, red

tem, to find, to invent

tem, to find

temt, hair, a lock of hair, a tress

tem, to find

tem, to find, to discover, earn

temit, to find that

temhiu, hair, locks of hair

temh, to watch, to observe

t, def: article, fem: sing: a feminine suffix.

" Ket, small, a muller, polisher

ta, to remain

tā, bread; tā hunt, white bread

tā, "

ta, " bread was considered to represent the matter, as water represented the essence, of the Gods.

tā, a heap

ta, the symbol of the table or bed whereon culprits were extended for punishment

tau nent, a place, a throne a suppser room

tāu, an instrument

ta, tash

ta to beat, to strike

ta, barley

ta, a part, a portion

tatā, to strike terror

tātā, to stamp, to throw to the ground

tāa, an emanation

tā, belonging to

tām, the sceptre Tam

tat, to give

taf, attention

ta, the, def: article sing: fem:

tāa to pollute

tā, warmth, to burn, to cook, light, torch

tai, the " def: art:

tā asher, a kind of bread

tāutū, slime, venom

tā t n aau, the seat of the grand assises

tatitū, an instrument

tāsh, some viand

tāsh, the fleshy part

tāsh, the frontier

tāt, to suckle, to feed

tasher, a viand

tash, to thrust into the mud

tāshiu, drunk, plunge

tashnaw, the rejected man, the drego of mankind

tāsh, a frontier, a district

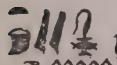
tai, a sail, to sail

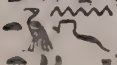
tāu, to burn. tām, skin

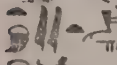
tāh, a swamp inhabitant, fisherman

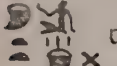
tāh, a child

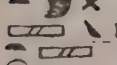
tāh, an inhabitant of the marsh, a fisherman

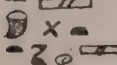

tai, warmth, to burn, to cook, light,


tā nenw, female police spy


tai, guilty, criminal


ta w, a judicial assembly, a jury


tāsh a frontier, a limit, a nome,

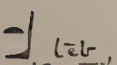

" " " "

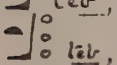
tāush, limit, the land belonging to a temple

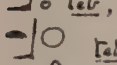
tā u rw, an enclosure, a partition, a hedge

tān, to extend, to elongate

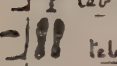
tāsh, frontier, nome, lands belonging to a temple


tēb, to fall, to stumble


tēb, figs

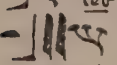

teb, a drum, a dulcimer

tēb to purify by fire

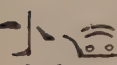

tebi sandals

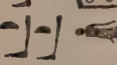
teb a weight for heavy or bulky material

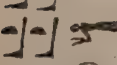
tēb, a hippopotamus


tebi, a plant used for food

teben, the top of the head, the summit


tēbhu, an arsenal


teb teb, to fall low, humble

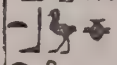

tebt, a chest

tēbtēb, to raise by means of a casastaw

tēb en ast ef, to stumble on his

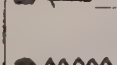
head

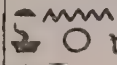
tēb, to draw water

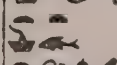

tēbu, a wine jar, a bottle

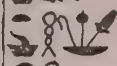
teb, figs

teb, to deprive, to despoil, to prick, to pierce

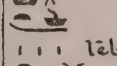

teben, a tambourine


tebt, a fish

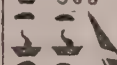

tebeh, that which is necessary

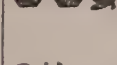

" " " "

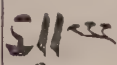
tēbhu, projectiles, arms, weapons


teb, grain

tebtēb, to immolate

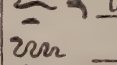

tebteb, to raise by means of a casastaw

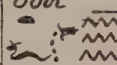

tebi, a branch, a twig


tēb, a finger's breadth

tef, a father,

tef, a handsaw


tēf, a father


tef, to moisten, to sprinkle

tēf, father, hoe, dance

tef, father

tef, divine father

tēf, to spit

tef, to hoe

tefi, to shake, to move

tefen, an orphan

tēfen, one of the seven decorations of the constellation

tēfew, to go from one place to another

tefen, to rejoice

" "

Teh

tefent, moist, damp, froth

tefnit, a bud

tehs, to stretch

Teh tebu, sandal maker

teh, to bow

teh, to ravage, to invade, outrage, wrong, perfidy

" " " " "

teh, to ravage

teh, to seize, to take

teha, to transgress, to infringe, to violate, to break in

teha, to embarras, to bar the way

tehamu, to invite, to excite, to push

tehaw, to elevate, to promote

tehan, to transgress, to infringe, to violate, to break in

tehi, " " " "

tehem, to visit, to excite, to push

tehem, to waste

tehemw, " "

tehemw, to approach, to visit

tehemi, to violate a tomb

tehemw, to cook

" tehemi, to assign, to direct by writing

tehemi, to inundate, to water

tehu, to crawl

tehar, an illustrious warrior

tehar, a kind of food

ti, two, 2, indicates duplication

tekk, attack, ambuscade

Tek Tem

tekki, to sparkle

tekiek, an enemy

tekek, to attack

tekkw, an enemy

tekemw, to arrange

teken, to approach, frequent

tek, see, behold, escape notice of

tek, food, grain, flour

tekkai, to fly

tekka, to illuminate, to sparkle, a spark

tekkateka, to attack

tekka, to attack

tek, to immolate

teker, perfect, absolute

tem, no, not, avoid, id.

tem, men, mankind

tem, a blade, to cut to pieces

temsu, a division of land

tma tma, satisfy

temnu, created persons, mankind

tem, no, not

tem, complete, intact, perfect

tem, no, not, exclude, avoid

tem, a shrine, a chapel

tem em complete, intact, perfect, shut, close; hati temem, a close heart, i.e. insensible, hard-hearted

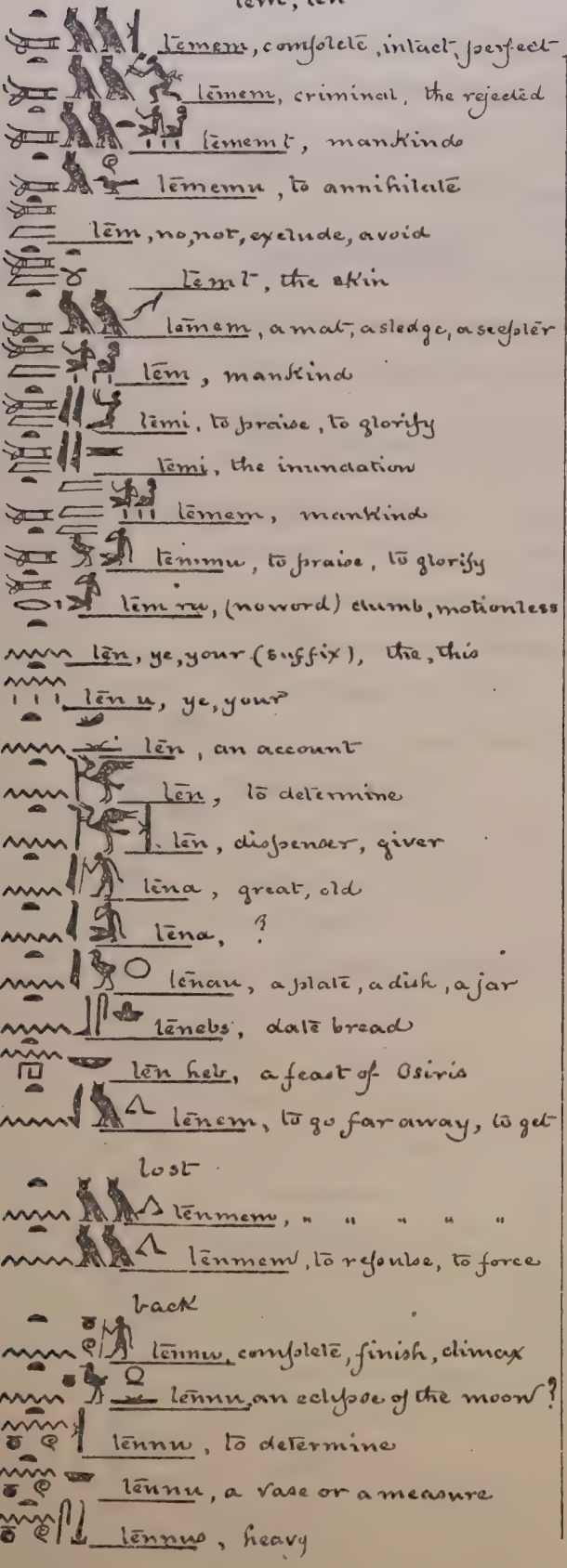
temem, " " " "

temem, a sledge for the sacred barge

temem, a criminal, the rejected

temem, for fear that

lēm, lēn


lēmem, complete, intact, perfect

lēmem, criminal, the rejected

lēmemt, mankind

lēmemu, to annihilate

lēm, no, not, exclude, avoid

lēmt, the skin

lēmem, a mat, a sledge, a sceptre

lēm, mankind

lēmi, to praise, to glorify

lēmi, the inundation

lēmem, mankind

lēnimu, to praise, to glorify

lēnmu, (noword) dumb, motionless

lēn, ye, your (suffix), the, this

lēnu, ye, your

lēn, an account

lēn, to determine

lēn, dispenser, giver

lēna, great, old

lēna, ?

lēnau, a plate, a dish, a jar

lēnebs, date bread

lēn heb, a feast of Osiris

lēnem, to go far away, to get lost

lēnmem, " " " " "

lēnmem, to response, to force back

lēnmu, complete, finish, climax

lēnnu, an eclipse of the moon?

lēnnu, to determine

lēnnu, a vase or a measure

lēnnus, heavy

lēn

lēnen, to hold

lēnennu, to conduct

lēnenset, a libation

lēnnu, grow, reckon, ration

lēnnu, with the following variants, , is a pronomial, adverbial, interrogative and admirative expression; it expresses, how much? every, where; which or what in number and quantity - how much?

su lēnnu. en ef, where is he?

er-tā en ek amu en ek lēnnu u, where did they give thee to eat?

xeper en ek lēnnu, what ails thee, what occurs to thee?

an ek lēr lēnnu, who art thou?

nen rex lēnnu sen, do not know how many there are of them!

er lēnnu er whalū hakt, how much (one) should avoid (drinking) beer?

lēnnu en ef shent meri lū ef, (how much) how great he is among his friends.

xe-

lēn, tesh

ḫper ra neb mesu sw lēnnu sebai, (the sun is) created every day, he is born every morning

er lēnnu ḫa aat, for every month, monthly

lēnnu sessu ḫru ment, every lēn days, i.e. every Egyptian week, which was composed of lēn days

ma enlit sen en lēnnu renpit, (like) according to their yearly contract. Lennu is also equivalent to, ax nima and ma.

lēnnuka, to listen

lēnu, Typhon, rude, fierce, vulgar

lēnt, a lapwing

lēnt t, a throne, a seat

lēnsh, to rejoice, to snap at

lēn, to cut off.

lēn, to complete, finish, climax

lēns heavy, weight

lēnt, a temple built within another. lēnas, a heavy blade

lēn t, a seat, a throne

neter t, a goddess

tesh, a chest, a box

tesh, the summit, heaven (pet)

tēsh, the summit, tosh, beginning, (eset)

tēsh, spotted earth, clay

tesh, to breathe, to taste

tesh, a cattle

tēsh, to tie, the head

tesh, ter

tesha, to inhale, to taste, to sniff, to breathe

tesha, food, all that can be tasted

tesha, to taste, to sniff

tēsha, a fat ox, a heifer, a buffalo

tesha t, to taste, inhale, sniff

tēsha, an ox, a buffalo

teseh, a secret ritual

" " "

tēseh t, the throat, the windpipe, a gate

tēsheht, a gate, a valve, abyss, a source, a hole, a cave, the hole of a snake

tēseh the throat, the windpipe

tēshiu, a fish

tēsht, a heifer

ter, who, what, then, all

ter, to drive, to rub away

ter, a season; it is often combined with the interrogative forms, adding energy to the question. em entek nima ter, who art thou now? Now then, who art thou?

tera neshni, an evil time, a fatal season

tera, to calm, to appease, to adore

tera, part of a funeral garment

terhui, servants

terra, admiration

teri, to adore, to involve

teri, the heel of the foot (see next page)

ter, time, season

ter, a willow tree

ḥer, ḥes, ḥet, ḥu

ḥer t, kind or quantity of bread fruit

ḥer, " " "

ḥer t, " " "

ḥer, to drive away, to rub

ḥerui, two times, twice

ḥeru, a measure of land, the branch of a river

ari fa u ḥeri, offerings of adoration, is idiomatic of the phrase, the King "is pleased with you", "gives you praise"

ḥeru, colors

ḥerut, times, seasons

ḥesnem, a libation

ḥasef, a kind of date bread

ḥasef, an offering

ḥes, to cut

ḥes, kind of cakes

ḥesef, bread offering

ḥesefṯ, a heap of dates

ḥeset, a sceptre

set, the ground, the floor

ḥes, a liquid or a liquid capacity

ḥet, a large vase

ḥet, an image, a likeness

ḥat, a dross, a type

ḥetu, bread for offerings

ḥut, an image

ḥut, a kind of food

ḥut, " "

ḥu, be, final past participle, a form of the future

ḥu-a, prefix for first person masc: my, I.

ḥu, a statue, a likeness

ḥua, abominable, detestable

ḥufi, reeds, papyrus

ḥuhar, an illustrious warrior

" "

ḥuha, to be drunk

ḥui, the, that; an affix of the demonstrative pronoun fem:

ḥuia, to net, to catch, to return

ḥui, abominable, detestable

ḥuk, thou

ḥunu, we are

ḥut, a kind of grain or food

ḥut, an image

ḥut, to tremble

ḥut, an image

ḥut, " "

ḥut, an image, honored, distinguished

ḥut, constituted, firm, established, agreement, contract, assemble, unite

ḥut, a kind of bread

ḥut, a likeness, an image, resemblance

" " " "

ḥut, to procreate, generator, father

" " " "

ḥer ḥut a, my engender-er, my father

ḥutu, likewise

ḥut, issue

ḥureṣ, a duck

ḥurutā, corn

ḥu, the French 'on', a passive termination

ḥua, I, I am

ṯu, ḳeḫ

ṯuek, thou, thou art

ṯuef, he, he is

ṯuat, an essence

ṯura, a willow tree

ṯurpa, a goose

ṯut, an image

or ṯutu,

em ṯutu ṯem ṯat ciu ef (of thou not give go he), do not allow him to go

ṯutu, to assemble

ṯut, an image, a likeness

ṯua, to raise, to carry, to lift

" " " "

ṯuaiu, " " "

ṯua, a column, a support, a prop

ṯua, the winds

ṯuat, ?

ṯuau, to adore

ṯuant, one of the seven oils for offering

ṯur, wash, dish, libation

ṯur, sing

ṯur, distil, wash

ṯur, "

ḳeḫ, a weight, a quantity of mine

ḳeḫ, a weight

" "

" ", a counterpoise

" "

" ", a liquid

ḳeḫ, a liquid, a weight

ḳeḫ, a sacred plant from which an oil was extracted

ḳeḫ

ḳeḫ, an ibis

ḳeḫebu, } to anoint, to dip, soak,

" } to impregnate

ḳeḫen, an obelisk

ḳeḫen an obelisk of frankincense

ḳeḫeni, closed eyes, invisible, hidden, wrapped up

ḳeḫni, to turn aside

ḳeḫnu, obelisks

ḳeḫnu, closed eyes, invisible, hidden, wrapped up

ḳeḫen, to walk upon, to touch with the foot

ḳeḫen, an obelisk

ḳeḫen, to hide, to shut up

ḳeḫen, closed eyes, invisible, hidden, wrapped up.

ḳeḫei, a plant

ḳeḫa, to cut, to wound, to mutilate

ḳeḫu, a weight

ḳeḫnu, to drink, to slake the thirst, to be drunk, to be drunk with joy

ḳeḫnu, rose

ḳeḫ ḳeḫ, revolt, shudder, trouble, confusion

" " " " " "

ḳeḫ ḳeḫ, to lose one's way

ḳeḫ ḳeḫ, to shudder, a tumult

ṯash, the frontier

ṯash, to enter

tēsh

tāsh, to leave

tashe, land of the lake

tēshi, a Nome

tēsh tēsh, Osiris' dead body

tesh tesh, left, destitute

tēsh t, to separate, to draw, to lead, discord

tēsher t, redo

tesht, to seize

tēsh, to separate, to draw, to lead,

tesbu u, leaves of a tree

tēs, to raise, to elevate

tā, a club, a prefix, demonstrative pronoun feminine, affix of the present participle

id; anxtā, the living

tā, a stick, a club

tas, an odoriferous wood

tā, a stick, a club

tāruaa, a door, a palace

tār t, a tree or some wooden article

tās, to sit down, to take a seat

tāsi, a cuirass, a military dress

tās, an odoriferous wood

tasi, a kind of plant, mint

" " " "

taura t, a tiller, helm

tehu, to rejoice

tehen, glass, or clear quartz

" " " "

" " " " crystal

" " " "

tahnuu, to compel

tash, a stable

tahen, to compel, to press

tahes, copper

tahesti, "; tahut, a plant

ti, dew

tai, a chief

tabtab, to scratch, to pierce, to lay low

tai, a plant

ti t the deck of a vessel

tiru, strong, powerful

tēharu, an oven

tāmu, a tree furnishing large logs & also an oil, probably the walnut.

tāmehu, the men of the north

tāmiu, one of the seven trees which were sacred in Heliopolis It was the source of a lamp oil. It seems to have been the walnut, though the walnut was not indigenous to Egypt.

tāmo, to swoop

tāmahu, to perceive

tāmah, a precious stone, a midwife

tāmes a writer's tablet

tāmes, rude, corrupt, coarse, savage

tān, this

tānent t, a parlor, a throne

tānuru, strong, powerful, valiant

tānru, " " "

" " " "

tānunukw, a jar, or some kind of wine

tār, a willow tree

lar, tat, tut

tārt, a willow tree

" " "

tārw, to rub, to afflict

t'rem, to cause to weep.

tarw, to rub, to afflict, to bruise

tārurw, an oven, a furnace

" " "

tāsu, a curved stick for fowling

tās, " " "

tāti, a stick

tātui, to speak, to say, language, words, voice

tāt, " " " " " "

tatti, to strike, to fight

tāt, a buckle

tā t tat, to fight, to strike

tu, throw

tui, a pair of sandals

" " "

" " "

tut, to speak, say, announce

tuni, a substance

tunti, a pair of sandals

tut to announce, to declare, to point out

tut u seshtā en peruu see, mysterious words of the great house (of the) six. The 'six' were priests holding the great mysteries

tāur, a libation

tex, a sacred plant from which an oil was extracted

tat

tat, to give, to place, to allow, to make, to do; tat em her, to give a mission, to charge one with doing anything.

tā ef her en amem t u, he gives face to the people, he watches over the people.

or tat aft au tā or tat aft er tē. to give the head to the earth, to die, to lay the head on the ground, to die.

tātā, to leave one place to go to another

tat aft, to shew the head, to shew oneself, to appear

tat her, to imprison, to surround

tat her " " "

tater tā, to place on the earth, parturition

tat sa, to give the back, to turn the back on, opposed to 'giving the face', to abandon, desert, neglect, renounce

tati, participial form of give, giving

ta su, he gives, he makes re

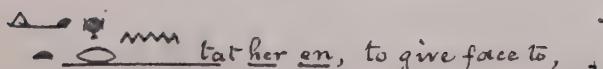
tatat, to leave one place to go to another

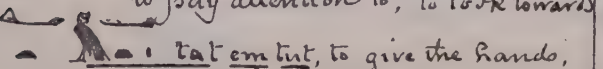
tatat, the Giver, gifts

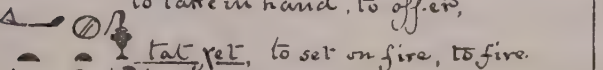
tatat hati, to please, to like, to desire

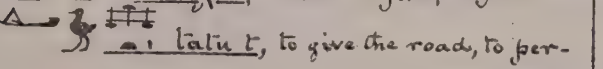
tāt, to give, to place, to put

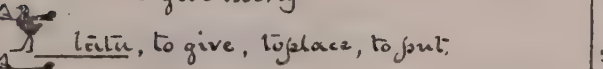
tat tut, to give the hand, to swear to adjure

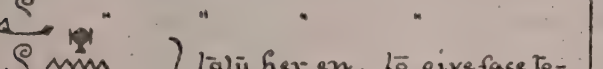

tat her en, to give face to,
to pay attention to, to look towards

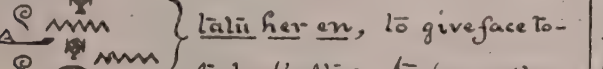

tat em tut, to give the hands,
to take in hand, to offer,

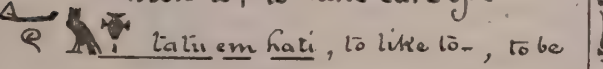

tat ṯet, to set on fire, to fire.

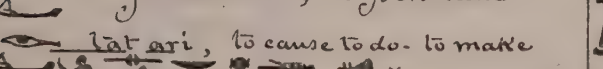

tātu t, to give the road, to permit, to give permission, to accord,
to give liberty

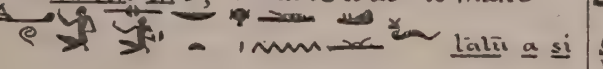

tātū, to give, to place, to put

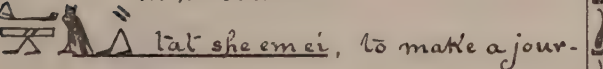

" " " "

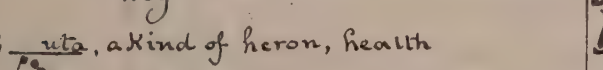

tātū her en, to give face to-
to look after, to pay attention to, to take care of-

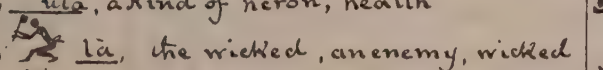

tatu em hati, to like to-, to be
pleased to-, to persuade

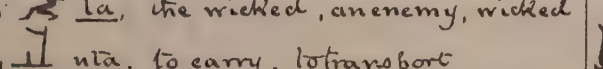

tat ari, to cause to do- to make

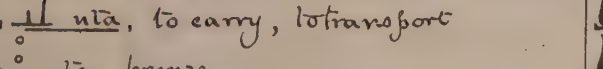

tātū a si neb her tenef, placed & person all place his, & put every person in his station


tat she em ei, to make a journey

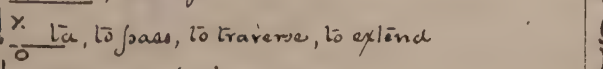

uta, a kind of heron, health

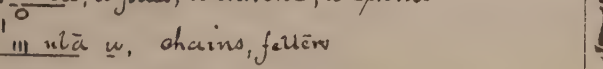

tā, the wicked, an enemy, wicked

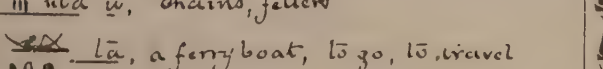

uta, to carry, to transport

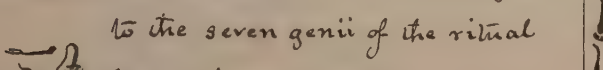

tā, bronze

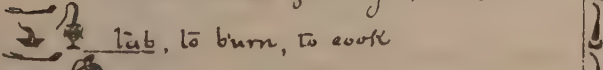
tā, to pass, to traverse, to extend

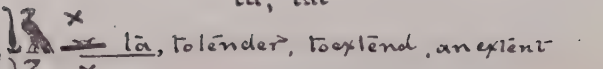

utā w, chains, fetters

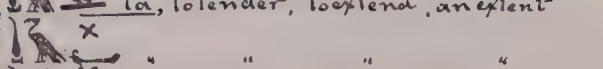

tā, a ferry boat, to go, to travel


tās, Lord, Master, the name given to the seven genii of the ritual


tāb, to burn, to cook


tāuk, a cry, a yell


tā, to lender, to extend, an extent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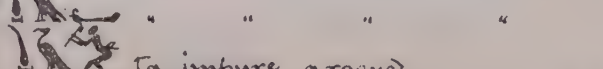
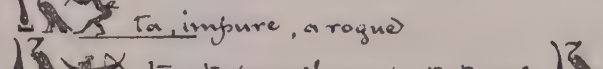
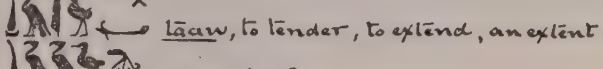
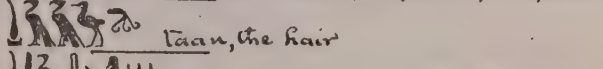
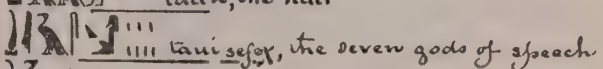
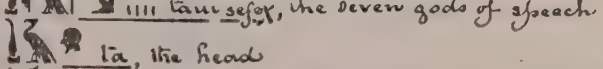

ta, impure, a rogue

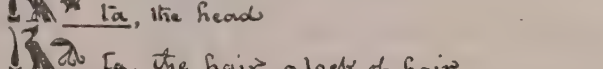

utā, to pass through, to travel;
utā em tā, to travel by lands.

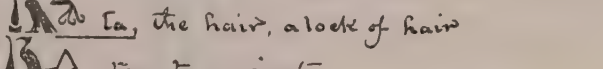

tāaw, to lender, to extend, an extent

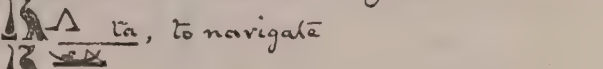

tāau, the hair


tāui sefex, the seven gods of speech


ta, the head


ta, the hair, a lock of hair


ta, to navigate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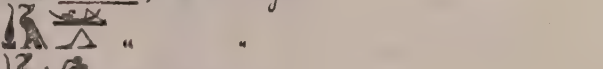
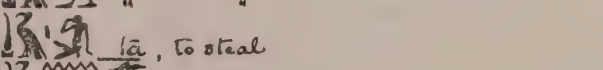
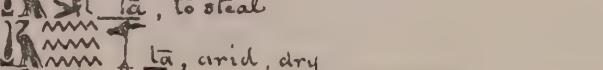
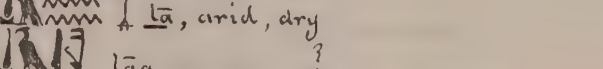
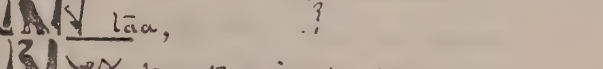
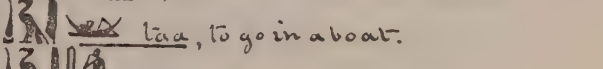

tā, to steal

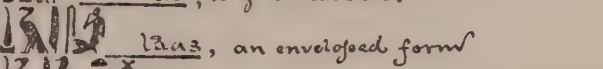

tā, arid, dry

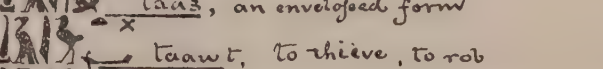

tāa, ?

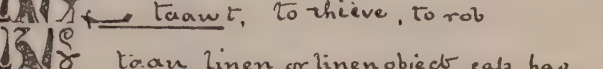

tāa, to go in a boat.

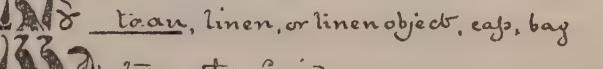

tāaus, an enveloped form

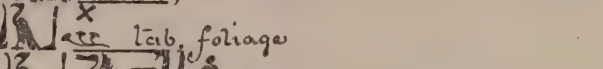

taawt, to thieve, to rob

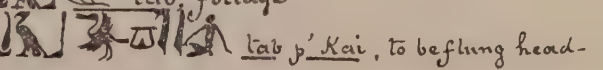

taau, linen, or linen objects, case, bag

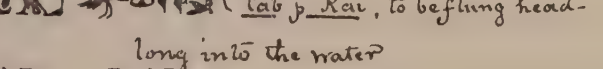

tāa, the hair

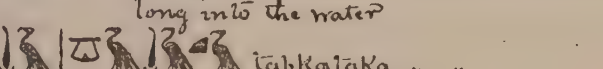

tāb, foliage

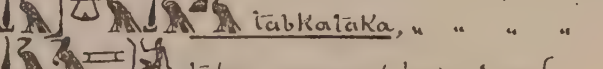

tab p' Kai, to be flung headlong into the water

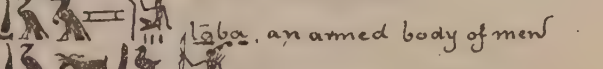

tabkatāka, " " " "

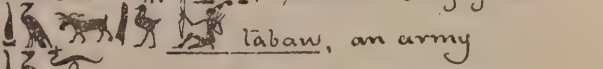

tāba, an armed body of men

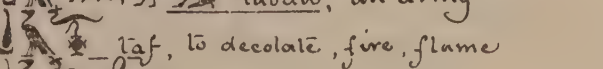

tābaw, an army

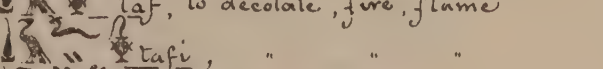

taf, to desolate, fire, flame


tafi, " " "


tai, rogue, impure


tai, part of a mourning garment


tai, to go


taiu, boats

tam, tar

tami, race, family, an association of people, a consortium.

tama, arido, barren, thirsty

tamat, a seat, a throne

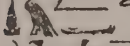
tami, to steal, to carry away

tamw, young people, youth, the members of a profession, generation

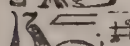
tamu u, laborers

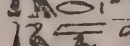
tamw, race, generation.

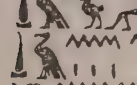
tama, a papyrus, a roll, a book


tama, to wrap, to swathe

tamru, a path


tamw. race, generation

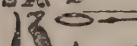

tanuna, a curb


tanana, misery, suffering, worry
tanini, ill luck, inconvenience, anguish

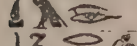
tapurnna, a wild beast, probably a wild boar

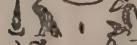
tar, smoke, ashes, reckon, horror, estimate

tarn, a lance, a pike

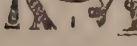

tar, to see, to look, to behold

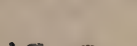
tarn, explorer, guide, spy


tar, to burn, fire

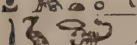

tarn, a hero

tarna, a piece of armor, a cuirass


tart, a pigment


tart, a scorpion

tamtu, a net

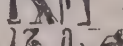

tarui, salt meats, preserves

tar, an enemy

tar, tat

tarnw, a plant, an ingredient of the Kyphi

tas, an enveloped form, (a mummy.

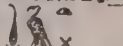

tas, a moralist, a discourse, a proverb

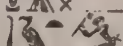
tatu, a throne, a chair

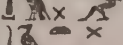
tatau, the head

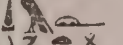
talau, throne room

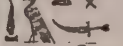
tat, a cross

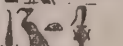

tat, an injure, an enemy


tat, a sharp instrument

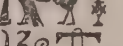

tat, a sword

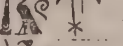

tat, fire, flame

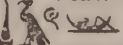

talu, " "

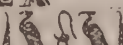

tau, the evening

tau, to navigate

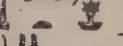

taucata, a bird


tept, decolate


tai, to travel through, to travel

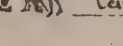

tam, young people, youth, generation, the members of a profession

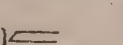
tam, to procreate

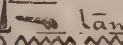

tanana, misery, ill luck, worry, inconvenience, suffering, anguish

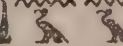
tenru, an oar

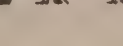
tenih, an arm (limb),


tart, a scorpion

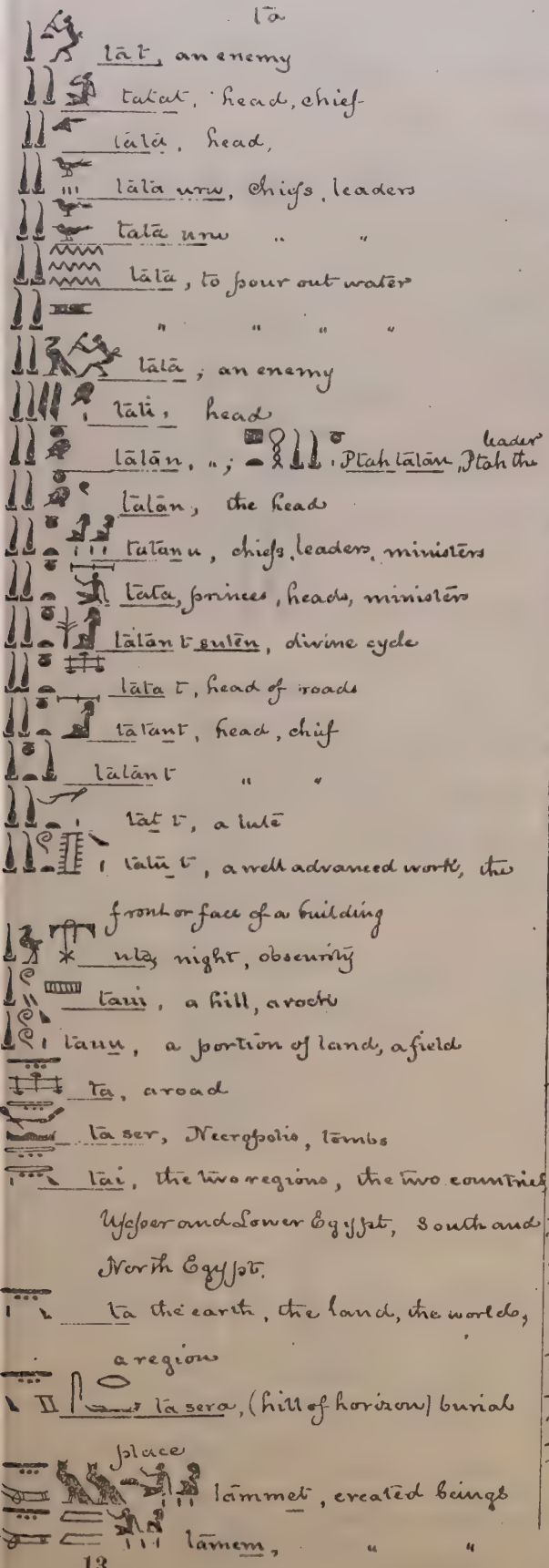

tat, to cook


talan, chief, first


tehehui, to rejoice


tat, enemy, falsehood, craft

tat, twenty


tāt, an enemy

tatat, head, chief

tātā, head,

tātā nnw, chiefs, leaders

tatā nnw " "

tātā, to pour out water

" " " "

tātā, an enemy

tāti, head

tālān, " ; Ptah tālān Ptah the leader

tālān, the head

tatanu, chiefs, leaders, ministers

tāta, princes, heads, ministers

tālān t sutēn, divine cycle

tāta t, head of roads

tātant, head, chief

tālānt " "

tāt t, a tutē

tātā t, a well advanced work, the front or face of a building

nta, night, obscurity

tani, a hill, a rock

tanu, a portion of land, a field

ta, a road

tā ser, Necropolis, tombs

tai, the two regions, the two countries Upper and Lower Egypt, South and North Egypt.

ta the earth, the land, the world, a region

tā sera, (hill of horizon) burial place

tammet, created beings

tamem, " "

tāra, time

tātanen a synonym given to Ptah in his province

tat, a papyrus scroll

tānni her hati, central lands or countries

ta urt, the eastern, left hand, side of a building, as am ur, is the western or right hand side.

ta sheti, the land of the lake

tā, to bear, to carry, a throne

tā or zar, a governor

tā, to bear, to carry, a magistrate, to take

tā, a male, man

tā, a grain, a pellet

tā, steps, a throne

tā, to bear to carry

tā, to carry away, to steal, to take, a robber

tā, to bear, to carry off, to steal

" " " " "

tā, grain

tā, to take, select (a wife),

tā, to carry, to steal, to lead

tā, enraged

tā, to take to carry away, to steal, a robber

ta, the hair

ta, wind, breath

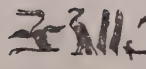
taāui, halves

tāb, to pass

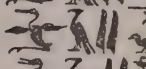
tābu, a jar

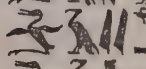
tai, to bear, bearer, to carry, messenger, banner bearer of guild

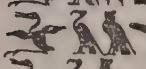
tāi, to bear, a bearer, to carry, a messenger, a banner bearer of a guild.

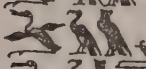

tai tutba, bearer of the 'cosper hand'; the standard bearer of the cosper workers' guild

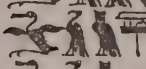
tai, male, husband

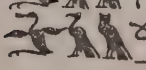

tai, an exception

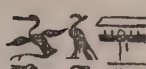

tāit, a librarian

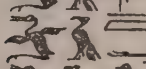

tām, male

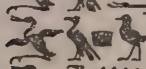

tām, to wrap, swathe, bandage


" " " "

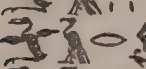

tām, to swathe, a bandage, a raiment


" " " " "


tāma, a papyrus roll, a book


tapsuka, barracks

tānuru, to deny


tāru, to surround

" "

tāru, an enemy, adversary

tārt, a threshing-floor

tarw, a call

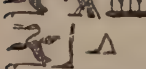
tati, thrones

tāui, to steal, to seize, a robber; idiomatically it also means to retake, to reprimand

tāui, halves

tāui, double, a couple, a pair

ta asha, a pen cutter


tāb, to pass

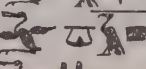
tābu, a jar

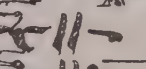
tābt, a stick, a switch, a flogging stick

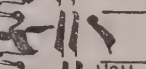
tahabu, a hippodrome,

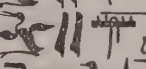
a riding school

takaru, a hall, a threshing floor

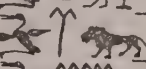

takasu, barracks

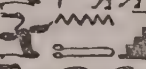

tāi, male

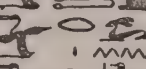

tāi, a roll, papyrus, book

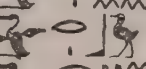

tāi, cloth, raiment, garment

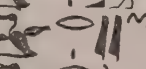
taku, a tree, wood


tānu, a lion

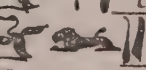

tānt, a throne


tārnan, blindness

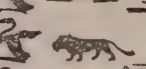

tanbu, a cup, a bowl


tārnina, a cuirass

tārutā, a barge

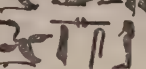

" "

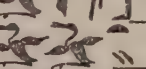
tāruhui, some movement


tā, a lion

tārnau t, an entrance

tārui, to gather

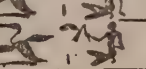

tāsao, an enveloped form

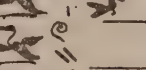

tāi ti, a couple, a pair, double

tāw, thieves' play, thieves' game,

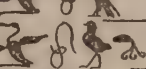
tā t, a throne

tāt, a governor, a fan bearer


tāt, a magistrate


tāui, bear off, carry away

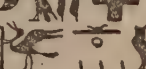
tāuaa, the hair


tāuaw, " "

tā xi, a wooden monument of some kind

tātyan assembly

tai, a threshold


tēnnw em anw, gum of the palm tree

ṯeb

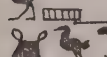
ṯeb ṯ, figs

ṯēb ṯ, a brick

ṯēb, a sarcophagus

ṯēb ṯ, a chest

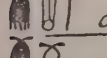
ṯēb ṯ, a brick.

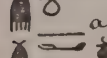

ḥauṯu, fields

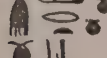
ḥauṯu, field-laborers

ṯsṯr, to clothe, clad, to equip

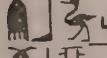
ṯsṯr ḥnḳ, white bread


ṯsṯr, a collar

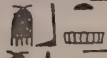

?

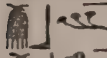

ṯēb, place, replace, recompense, instead

ṯēḳr, a sarcophagus


ṯēb, to close, to shut

ṯebṯ, a brick

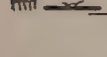

ṯēb, a crown, a chaplet


ṯēbu, chaff

ṯebu, equip, wrap, feet

ṯsṯr, to furnish, to equip, to put on armor, to garnish

ḥeḥ ṯsṯr, the 21st day of the month

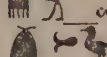

III ṯēṯreṯi, an ornament for the neck

ṯsṯrw, a collar

ṯēbu, geese

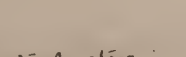
ṯēbu, a place

ṯi ameni, an interpreter

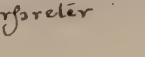

ṯkṯ, to weave, to place

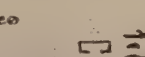
ṯait, a book, a papyrus roll;

ṯṯr ṯait, a library;


ṯāiṯ em ṯēruu amenu, a book full of colors (paintings)

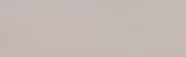
ṯat, to give, to cause;


ṯat a arṯ, I give wine;

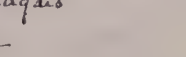

ṯat

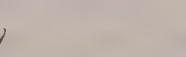
ṯā

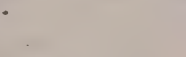
ṯaṯi, I cause to be made (I give it be made)

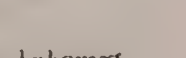

ṯā ṯsṯ, to put, to place

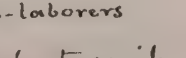
ṯaṯ apṯ, to shew the head, to appear

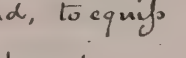

ṯsṯ, a cereal, grain, wheat

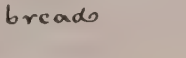

ṯaṯ anx, give life, was placed after the titles of deceased Pharoahs; it will read, 'to whom was given the second life,' and after the name of a deity, 'the Giver of life'

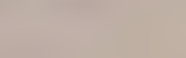

ṯaṯ ṯuṯi aw-, to extend the hands towards

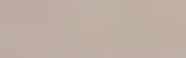

ṯaṯ ṯuṯi er-, " " "

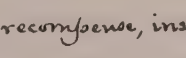

ṯēm, to put, to place in, to give a place

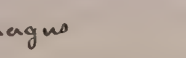

ṯaṯ em ḥer-ew-, to put at face of, to place before, to submit, to confide, to give a mission to

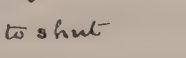

ṯaṯ snṯr ḥa apṯ, to shew oneself, to appear.


ṯāṯ ḥaṯi, to please, to like, pleasure


ṯaṯ, to give, to cause to, to place, to direct that-

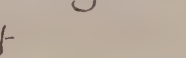

sepuw, when preceded by aner, a stone, is a kind of stone mentioned in medical formulas, may be the Lapis Memphites mentioned by Dioscorides

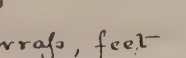

ṯāṯi em ḥer, to place before, to submit, to confide, to give a mission to-


ṯām, a scepter, strong

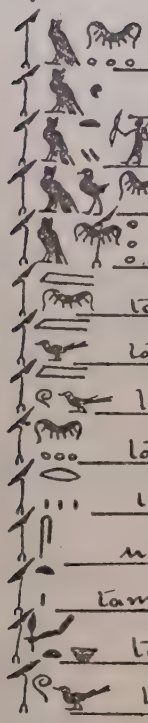
nas, peace, quiet happiness

ṯāmiṯ, raw, ruined


ṯām, pure


ṯāmur, corrupt, weak, ruin

tam, ter



tāmi, gold

tāmi, ?

tāmti, to attack

tāmu, gold

tām, gold or enamel, gild

tāmi, gold

tām, rain, weak

tāmu, unfortunate, ruin

tām, gold

tāmer, sound

nas, to injure

tām, strong

tesert, cream, cheese

tāmu, unfortunate

tēmt, to meet, to rule over N. & S. Egypt

xab, to rule over N. or S. over Egypt

xab, the place of execution

tēmtu, assemble, total, aggregate

tēmtu, the total, to amass, to collect, the aggregate

ter, whilst, during, entire complete all-

neb er ter, lord of all, since

ter, " " " " "

ter, to engender

ter embah, all before, previously, before times

ter, work, make, fabricate, manufacture

ter, limit, extreme, frontier, aim

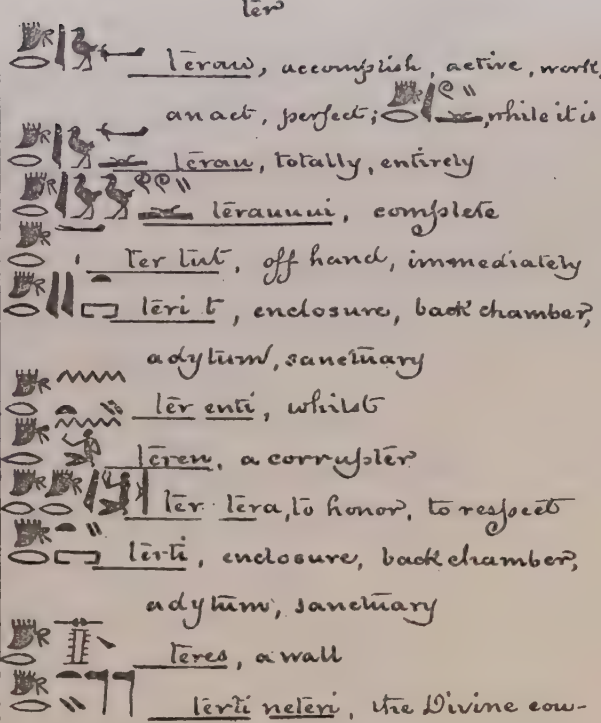
ter, to form, to build, to limit, to hinder, to surround, to wall

tera, a wall, a pilaster

tera, a bird

teratera, a licentious man

ter



teraw, accomplish, active, work, an act, perfect; , while it is

teraw, totally, entirely

teraunui, complete

ter tist, off hand, immediately

teri t, enclosure, back chamber, adytum, sanctuary

ter enti, whilst

teren, a corrupter

ter tera, to honor, to respect

terti, enclosure, back chamber, adytum, sanctuary

teres, a wall

terti neteri, the Divine couple, Isis and Nephthys

" " " " "

terti, a pair of birds

teru, a ladder

teruu, some part of the human body, the heel, the chest

terur, colors, painting

terututu, to tally

teruu, circumference

teruu, rolls of papyrus, books

terur, limit

termu t, secret corridors built in the walls of the temple of Dendera

ter embah t, before

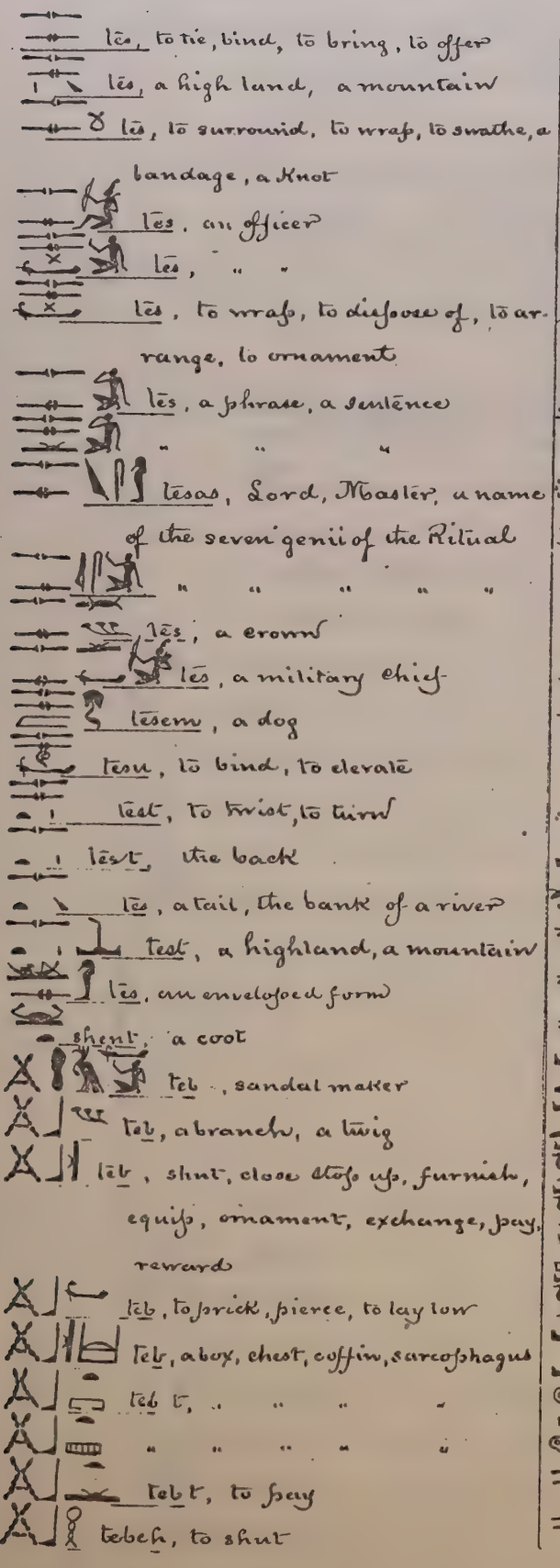
ter u, the whole, proper

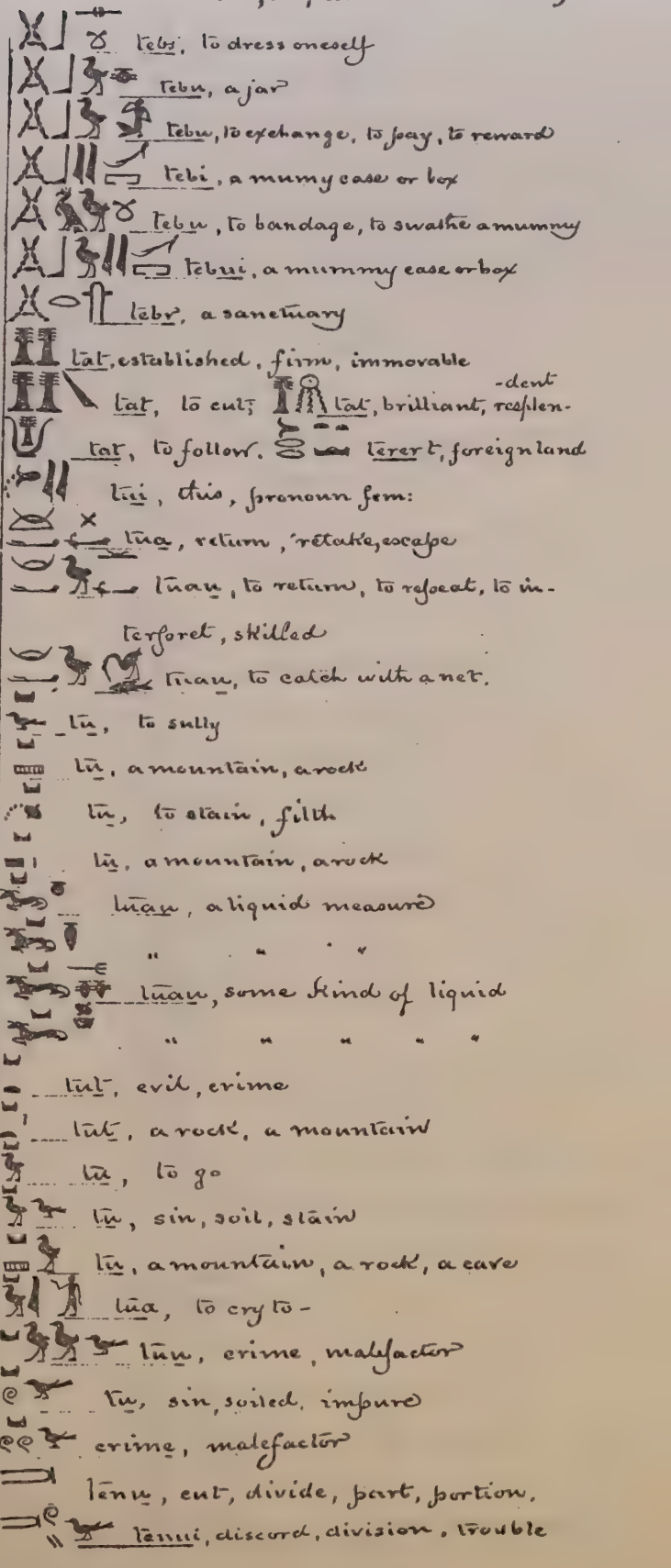
tes, a tail

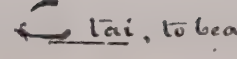
tes, vice versa, in turn

tes, a bowman

tes, refined; sword, to swathe, a knot

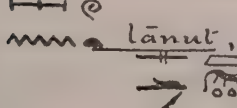

tes, to tie, bind, to bring, to offer
tes, a high land, a mountain
tes, to surround, to wrap, to swathe, a bandage, a knot
tes, an officer
tes, " "
tes, to wrap, to dispose of, to arrange, to ornament
tes, a phrase, a sentence
" " "
tesas, Lord, Master, a name of the seven genii of the Ritual
" " " " "
tes, a crown
tes, a military chief
tesem, a dog
tesu, to bind, to elevate
test, to twist, to turn
test, the back
tes, a tail, the bank of a river
test, a highland, a mountain
tes, an enveloped form
shent, a coot
teb, sandal maker
teb, a branch, a twig
teb, shut, close stop up, furnish, equip, ornament, exchange, pay, reward
teb, to prick, pierce, to lay low
teb, a box, chest, coffin, sarcophagus
teb t, " " " "
" " " " "
tebt, to pay
tebeh, to shut

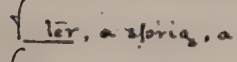

teby, to dress oneself
tebu, a jar
tebu, to exchange, to pay, to reward
tebi, a mummy case or box
tebu, to bandage, to swathe a mummy
tebui, a mummy case or box
tebr, a sanctuary
tat, established, firm, immovable
tat, to cut; tat, brilliant, resplendent
tat, to follow. terert, foreign land
tui, this, pronoun fem:
tua, return, retake, escape
tuau, to return, to repeat, to interpret, skilled
tuau, to catch with a net.
tu, to sully
tu, a mountain, a rock
tu, to stain, filth
tu, a mountain, a rock
tuau, a liquid measure
" " "
tuau, some kind of liquid
" " " " "
tut, evil, crime
tut, a rock, a mountain
tu, to go
tu, sin, soil, stain
tu, a mountain, a rock, a cave
tua, to cry to -
tuu, crime, malefactor
tu, sin, soiled, impure
crime, malefactor
tenu, cut, divide, part, portion,
tenui, discord, division, trouble

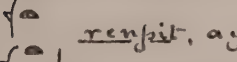

tāi, to bear; to carry, a messenger, a bearer; it is an abbreviation of tāi

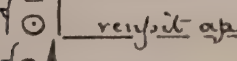
tāi abu, an inspector, a controller, as, 'wine inspector', 'Pharoah's butler'

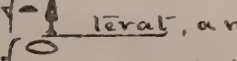
tāi mau, bearer of truths

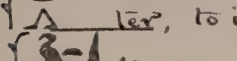

tānut, completed, perfected; set em nub baku tenu em nub tām, (he built a house) garnished with gold (and) completed with enamel

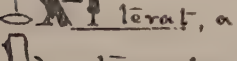

ter, a spring, a shoot

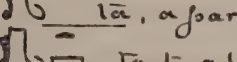

renpit, a year

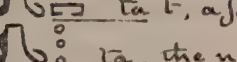

renpit apa, the first year

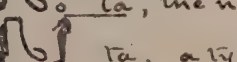

terat, a willow tree

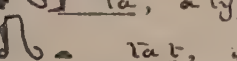

ter, to indicate to shew

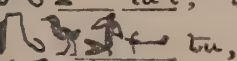

terat, a willow tree


tā, a part, a portion

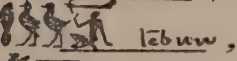

tā t, a portion of framework

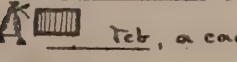

tā, the name of a precious metal

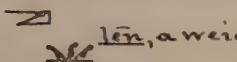

tā, a type

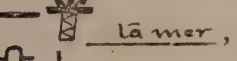

tā t, "

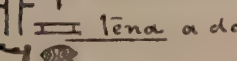
tu, to cry out, to invoke

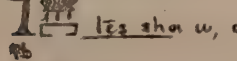

tebu, sandal maker

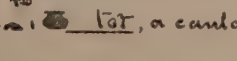

tebuw, " "


teb, a cage

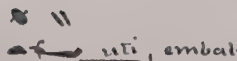

ten, a weight equal to 10 Kat

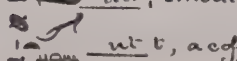

tā mer, the land of Egypt

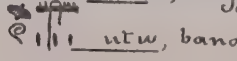

tena a dam, a dyke, a bridge


tes shau, a hall in the temple

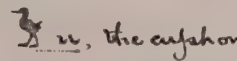
tet, a cauldron

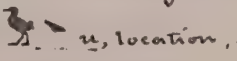

uti, embalmment


ut t, a coffin

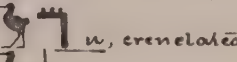

utu, bandages, swathes

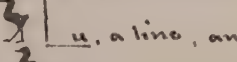
U

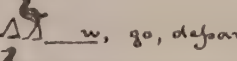

u, the euphonic suffixport of the pronoun 1st person

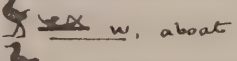

u, location, soil, place, the grounds belonging to a temple or to a city

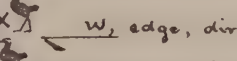
" " " " " "

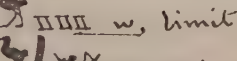

u, crenelated, loopholes


u, a line, an edge


w, go, depart

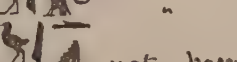

w, a boat

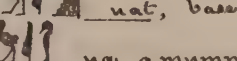

w, edge, direction

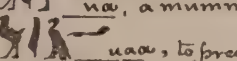

w, limit, edge, line

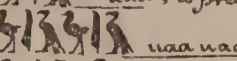
ua, a boat

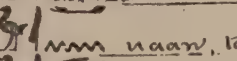
uaa, a boat


" "

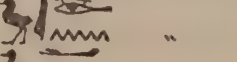

uat, base, base of a pillar &c, socket

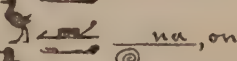

ua, a mummy case


uaa, to present, offer, transmit, remit


uaauaa, to tangle, to embroil

uaaw, to neglect, to leave aside


" " " "


" " " "

ua, one, sole, alone

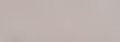
uaf, to bind, squeeze, compress

uat t, a leg

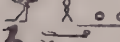
uar, a tree furnishing wood for coffins

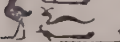
nana, to strike with the sword, to massacre, to cut down, to fell

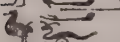
naf, a kind of wheat


naf, to chastise, id:

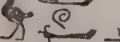
nafw, " "

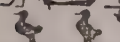

naw, a lieutenant, or

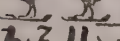

nama, large bodies of men

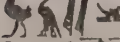

nai, a boat

nanw, that which is far off, distant


naa, to curse, to execrate

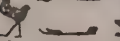

naa, a torch, id:


unt, a beam


unt, girdle, apron, waistband

unt, a wall, a fortress, tower

untá, to verify, to examine

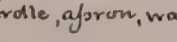

unt, a pylon

unt hatí, intrepid, stout-hearted

unt, thickness

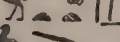
" " uní, to engender / to procreate

ub, to shine

ubew, to shine; 
nen uben shu Ra, the sun's rays give no light

uben, a sore, a wound, mud

uben t, an informer


ubni, the blaze of flame, fire

ubs, to gather wheat into sheaves

ubs esf ?

ubet, to boil, to cook, to burn, to melt

ubs, to sprout, to shoot

nu ubet, boiling water

ubeb, to boil, to cook, to burn, to melt

ubex, the skin of an animal

ubex, to shine, luminous, brilliant

white

ubex, to shine, luminous, brilliant, white

uf, a drops, pressed out, squeezed out

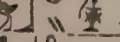
ufa, to grasp

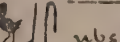
ufa, to extinguish, to chastise

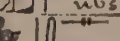
ufi, the lungs

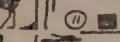
uf ufa, to extinguish, to chastise

uf w hati the lungs

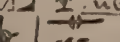

uha, to gather in


uhaw, the coming of night, approaching darkness


uhebw, a heifer


uhi, a tribe

uha, to cut down, to sack, to lay waste, to destroy

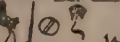

" "

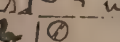
uh, to escape, abortive, to avoid

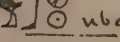
uha, to miss, to fail

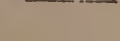
uha, to long, to desire, to forget

uha w, weary


uhaw, night


uha uha, to desire


uhab, a fish


uhaw, to reverse, to overthrow

uhai, to escape, to miss, to fail

uhiu, "

uhar, a dog

" "

ni, a participial final, prosper, good

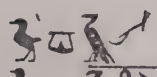
niti, the swathing a mummy, the mummy swathes

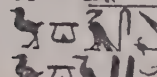
uka idleness, to rob

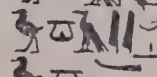
uka, a festival, the festival of the ancestors

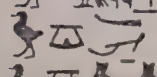
uka, indolence, idleness

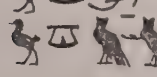
uk, us

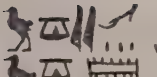

uka, a peg

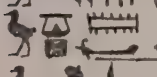

ukaa, to salt fish


ukai, the bends of a vessel

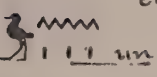

ukahw, " " " "


ukem ma nu xeriw, a seed bed of grains of myrrh; (myrrh was used in funeral ceremonies)


ukai, pegs


ukuf, destruction

uw, an ebony tree, an extract from Yabasu (Byblos) in Phenicia; according to Pierret, a Carob tree

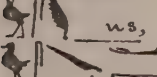

un, hieratic form of the pronoun third person plural

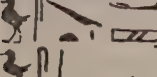
unn, a kind of bread

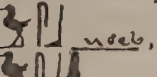
unsh, unction water, mud

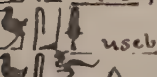
ur, great

us, a saw; us, width extent

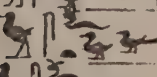

us ash, cedar-saw-dust


useb, to slack, to gather wheat into sheaves


useb, to sever


usef, leisure

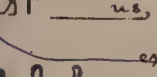
usef t, leisure, idle, negligence


usfi, to relax, negligence, idleness

usch, to cut, to mow

us, very, very much, large, vast, extended, desert, void

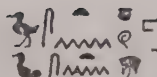
usehw, to destroy by fire, to burn

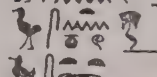

ust, saving

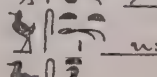
usti, a letter, a message, a mandate

uslen, to dilate, to extend the legs, to walk

us, ut

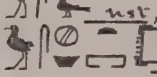

ustennw, a station

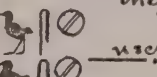

ustennw, a cynocefahalus

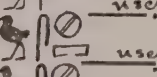

usti, a volume, a letter, a writing

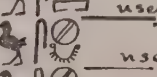
uslu, " " "

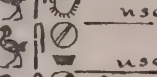
ust, devastate, ravage, ruin

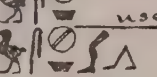

usex t, a large hall with columns, the judgment hall of the dead

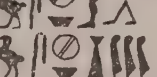

usex, a collar; us, width, extent

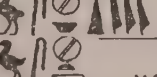

usex, a threshing-floor

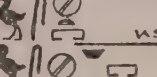

usex, a collar

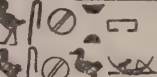

usex, large, broad, widened

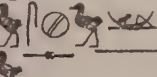

" " " "

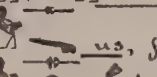

usex, a hall, a temple


usex t, a hall


" " us, { empty void to miss

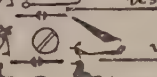

usexu, a boat of burthen

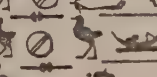

us, produce, create

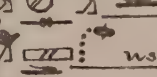

uslen, to dilate, to extend the legs, to walk

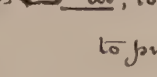
ust, to devastate, ravage, ruin

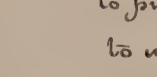
usex, to mow

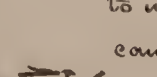

usxu a boat of burthen

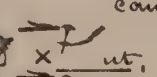

ush, evacuation, faeces


ut, to throw, to lance, to emit, inflict, to put forth, to use violence against, to utter cries or exclamations, to cause

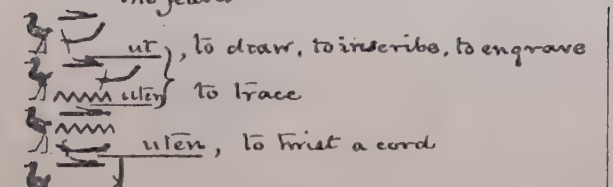

ut, to put forth


uteb, a title


uteh, a large jug


utew, an offering;
rut en ef utew xer heb, (grow of him offerings forward feast), he multiplied offerings for

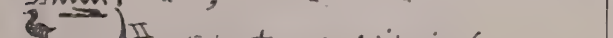
the feasts

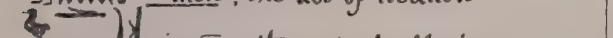

ur, to draw, to inscribe, to engrave

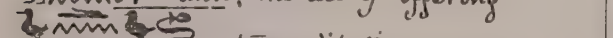
urer to trace

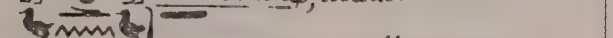
urer, to twist a cord

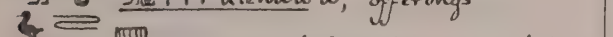
" , " "

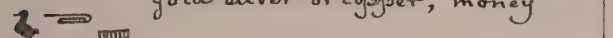

II urer, the act of libation

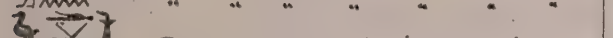

urer, the act of offering

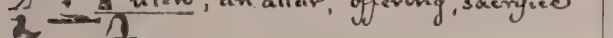

urerru, libation

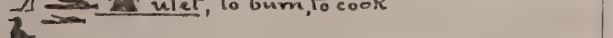

III urerruw, offerings

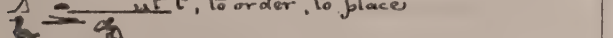

urer, a weight, heavy, a weight of gold silver or copper, money


" " " " " " " "

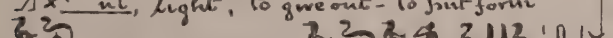

urer, an altar, offering, sacrifice

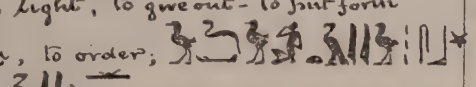

uret, to burn, to cook


ur t, to order, to place

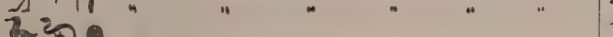

ur t, to endeavor

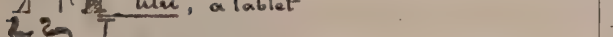
ur, light, to give out - to put forth

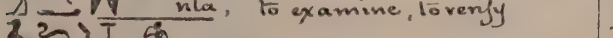

uru, to order;


, nlan tain shaw n ar-fer, ordered the sinful ones to be chastised

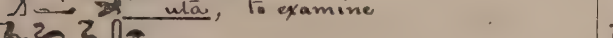
" " " " " "


urer, a tablet

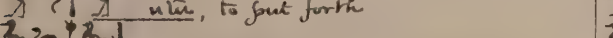

nla, to examine, to verify


nla, to decide

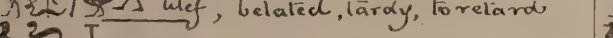
nla, to examine

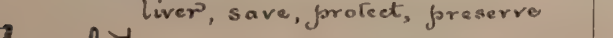

nlaas, to carry, to load a vessel

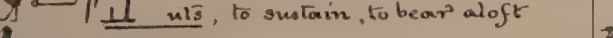
urer, to put forth


urer, to order, to issue forth -

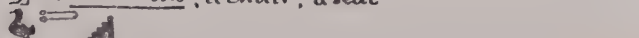
uref, belated, tardy, to retard


uret, open, until, disengage, deliver, save, protect, preserve

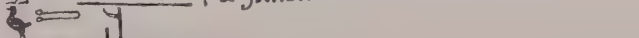

urs, to sustain, to bear aloft

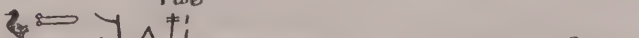

" " " "

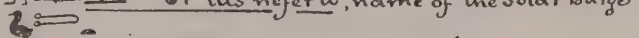
urs, a chair, a seat


" " "

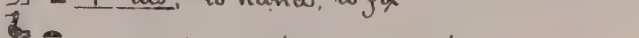
urs, a pillow

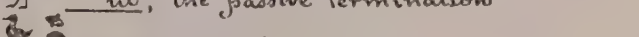

urs, to carry, to raise, to elevate, to make rise


urs neferw, name of the Solar Barge

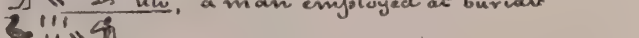

urs, to suspend, to sustain

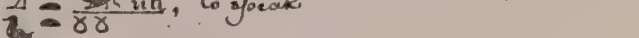
urs, to hand, to fix

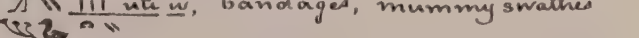

ur, the passive termination


ur, a coffin

uru, a man employed at burials


uru, to speak

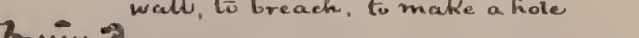

III urw, bandages, mummy swathes

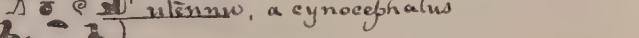

uri, a farmer, an agriculturist

uren, to offer

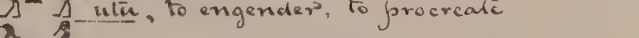
I urew, heavy, weighty

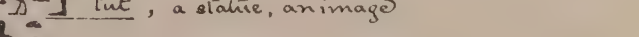
urennw, to pierce through a wall, to breach, to make a hole

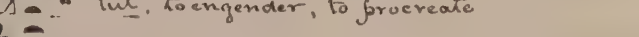

urennw, a cynocephalus


urennww, heavy, weighty

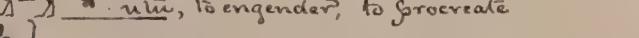
uru, to engender, to procreate


tut, a statue, an image

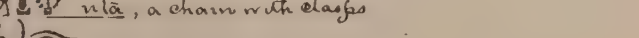

tut, to engender, to procreate

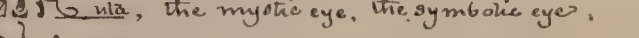

tut, a fault

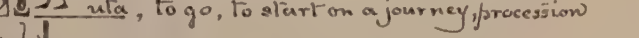
uru, to engender, to procreate

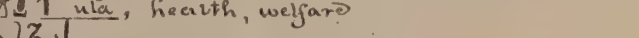

nla, health, to be in good health

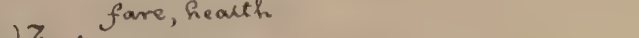
nla, a chain with clasps

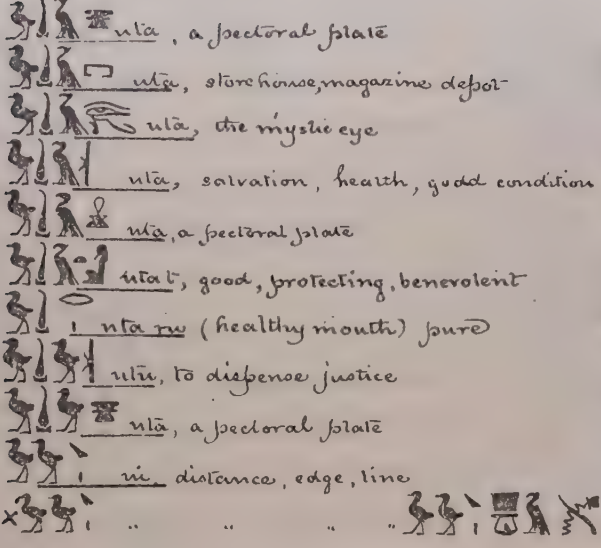

nla, the mystic eye, the symbolic eye,


nla, to go, to start on a journey, procession


nla, health, welfare


nla, in good condition, intact, preserve, content, well being, satisfaction, welfare, health


nla, to start on a journey, to go forth



ulā, a pectoral plate

ulā, storehouse, magazine depot

ulā, the mystic eye

ulā, salvation, health, good condition

ulā, a pectoral plate

utat, good, protecting, benevolent

1 uta ru (healthy mouth) pure

ulu, to dispense justice

ulā, a pectoral plate

1 ui distance, edge, line

" " " "

ui peka, a region intermediate between the two worlds, the Gap; in passing through the uipeka the gate of Amenti becomes visible

uu, happened, to occur, to come to one,

uxes, to mould, form, create, build

ux, a column

ux t, a chapel

uxt, inflammation (intestinal) swollen

ux, a column

uxer, a chapel, chamber, shrine

uxet, inflamed, swollen

uxuax, a meadow

uxexa, a colonnade

uxexaw, night

usf, to follow, to leave

ut, ignorant

uha, a barge, a boat

1 uha, night

uha, pillars

uhau, incapable, inexperienced, inapt, undisciplined

1 uxa, a communication, a letter, a papyrus roll

uxai, a communication, a letter, a papyrus roll

uxaax, to watch, to follow, to search

uxaax, curiosity, indiscretion, insubordination

ush, a desert, devastated, void

ush, nightfall, darkness

usha, to eat, feed

" " "

ushab, an offering made to the Gods by the King

ushab, a vase used in the ceremonies of the mysteries of Isis

ushabt, a woman to be hired for lamentation, or crying at funerals

ushab, to answer, to reply

ushab, to answer, to reply, report, revelation, denunciation

ushabtiw, replyers, answerers, the terra cotta figures placed within or without the sarcophagus, often buried near it

ushab, to consume

ushabw, to answer, reply

ushemu, essence, decoction

ushemu, to grind, to devour, to gnaw

ushem, an ear of grain

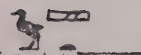
ushemu, a beer jug

ushem, to fowl, to net

ushenu, a pelican, to fowl

ushenu, a dead bird

usher, to be empty, to miss, a void


ushṯ, to implore

usḫ, a pelican

usha, nightfall, darkness

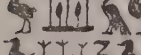
usha, to pasture

usha, a pasture

usha, a herdsman, lay low, break, to

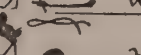
usha, to trap

usha usha, stubborn, to beat


ushabti, the small funereal figures, placed in and near the sarcophagus, called 'Answerers' who replied for the deceased before the ceremony of Āp rw

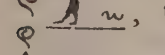
ushet, to acquit, to absolve, to adore, to appropriate, to render propitious

ushu, " " " " "

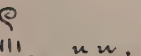

ushṯ, to work, to prepare

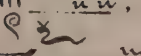
w, he, him

w, to adore

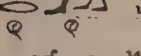

ew, to come, to arrive; or

ew en ef or en ef, he came, he arrived

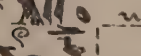

wn, they, them


waf, to chastise

wax, to flee


waw, a captain

wai, a substance

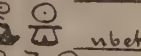

wanṯi, a persea tree

wamti, numerous, multiplied

wb, a window

wb, to tame

wbeḳ, to dart rays, to sparkle


wbn, light, sunrise

wbn, light, sunrise, daylight, dawn

whai, to escape, to avoid

wbeḫ, to be covered, a cover

wheb, a fish

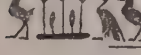
whem, to consume

wha, to avoid, to escape

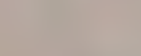
wka, a festival

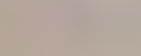
wkaw, the waters of the inundation

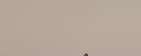
wn, issued from, pine wood


wn, open, to open

wṯ, the great court, or colonnade, which was behind the pylon

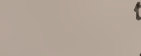

wtā, a passage, or a corridor, in a tomb


wtes, to try, to examine


wtes, round, haughty

wtes, the heights of heaven

wt, the passive termination


wt, to wrap in bandages, to swathe, to dress

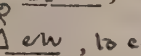
wrex, to be verdant, to become green

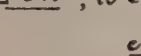
wresh, " " " "

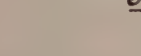
wt, to put forth, to produce

wamti, a wall, fortified, rampart;

wamti hati em snaki w, a heart fortified in battle, strong hearted in battle or in the melée, stout hearted


wnā, to preserve, content, health, well-being, welfare


wnā, a kind of tree, well being, welfare, in good condition, healthy


" " " " " " "

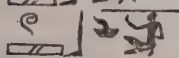
wn, edge, limit, canton, territory

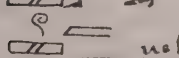
wnnt, a washerman

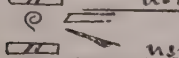
wnt w, the high mountains. In the

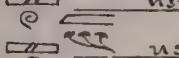
Ritual it indicated some locality, where the soul went to, connected with Amenti

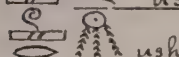
nsheb, to answer, reply

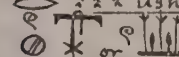

" " "

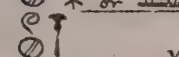

nshem, to consume, to destroy

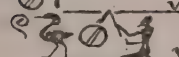

nshem, to kill, to destroy

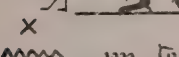

nshem, an ear of grain

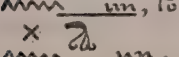

nsher, dry, arid, dried up

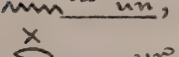

or
nsha, closing in of night


ux, a column

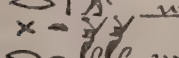

ux, a spirit


un, to polish, to prepare


un, a lock of hair

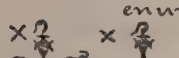

ur, great, strong, powerful

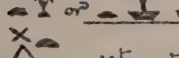
ur, eldest

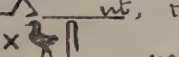

urti, the two uræus

urtu, to cease, to rest

s'hui, to make out a list, to enumerate

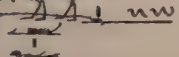

or
urt, fire, flame

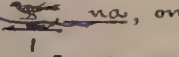

ut, to go

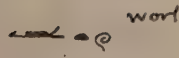

us, extent;
em use neb, the whole extent

uu, evil

uu, the domain of a temple or city


ua, one, alone, solitary, isolated


ua, one;
ua am her ari t seht se xa, (one amid on make effort person thousand,) one of the men was working like a thousand men


naiu, lone, left alone, aside, isolated

naaw, " " " "

em bu ua, in one place, assembled;
ua neb, one all i.e. everybody

nai, two

ua ua, together

uaw, one month, one

uat, one

ualu being alone, being solitary

uarer, to become green

ua, to lift, to carry away

ua, to carry, to bear, to transport

" " " " "

ua, to go along, a distance, a journey

uaa tu, workwomen

nahu, to place, to add, to develop, pros-perous

nahua, grand, ample, considerable

the word expresses a general idea of augmentation

narlu, a rose

nars, a reed, a grain stalk

,
ru en uaa, in the vicinity, neighborhood, proximity

uas, the sceptre, called also the Jam

narer, to become green, verdant

naraiu, violets

nalu, to take away

naw, fire, flame, malt

nanu, afar, to be at a distance from

nani, to discourse, to meditate

naw, the road, the way, the side (right or left), the public highway

nana, to consider, to meditate

" " "

nana, to shine

nax, a marsh, a meadow

nax, entrance

nax, a marsh, a meadow

nataaw, a fluid

nash, to invoke

nash, to break, to crush

nashaatati, ophthalmia

nab, heap, pile

" " "

nahua, to stand, to place

nak, one of the principal feasts of Osiris

nakt, offerings for the festival of navigation

nar, a cord, a rope

narsa joyful, overjoyed, charmed

namem, a mythological serpent

narer, a vine

naseri, Osiris

naua, to throw oneself on-

nauau, soiled places, uncleanness

nanat, to found an edifice, to lay the foundation stone

nannau, " " " " "

nat, color green?

nat, color "

na t, a journey

nat, distance

nauu, walking along

nanai, to consider

nana, light

nana, fire, heat

nannani, to consider

nash, to call

nah, increase, multiply, flourish, augment, throw

nah renpit ashw, to fulfil many years. em nah, besides, afterwards

nah, a helmet, a buckler

nah, very much; s'hwen ef em ef sam em tau en em tut nah en ef, he ordered him to conduct the world, by hand, an infinite number of times. (Osiris's order to the Sun.)

nah, to augment, to increase, flourish, to spoil, to throw down

nah, to place, to deposit, to establish, to place on, to put, to add, to erect

nah apt, to bend the head, to incline, to obey. an nah nefer, to do better

nah hati, kindhearted

nah, a royal title

nah, a kind of fish, to fish, id.

nahit, grain, a garland

nahi, grains of wheat

" " "

nahi, a water carrier, a water furnisher

nahet, to labor

sekt, to grind flour

nah Ka, by the body of - (such a person) a form of oath

?

nah tut, to lay hands on, to steal

natiu. ? a beverage?

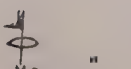
nahu, a collar

nah, user, nat

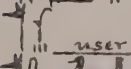
nahu, magnificent

nahu, laborer, ploughman

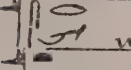
user, powerful, power, rich, force and power, sustain, rule, valiant


" " " " " "

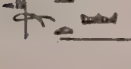
" " " " " "

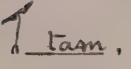

user renpitu, rich in years

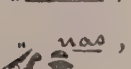
user w, strength (s) forces


user, an oar

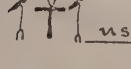
usert, the spinal column


set, the lower region, subterranean region, the tomb


tasn, a sceptre with a Grey hound's head


nas, peace, quiet, happiness of Amenti

nas t, a grey hound


user any, full of years, plenitude of years, rich in years, ages of existence

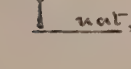
nasem, feeble, disintegrated, in mins

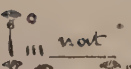
" " " " "

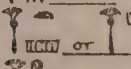
nasmi, " " " "

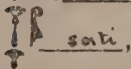
nasem, a metal, copper?

" " "


nat, green, fresh, papyrus, tank, pool, Lower Egypt


nat a color, collyrium


or nat, emerald green, a tablet


sati, to dart rays, radiant

nat, offering bread or cake

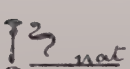
nati w, green herbs, papyrus

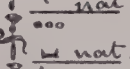
nbw, heaps of sand, trenches

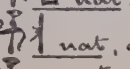
nati, the two uraeus, a Goddess and a Temple built to that goddess by Rameses II.

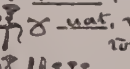
nat mes, collyrium

nat, un

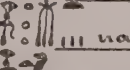

nat, to order, to transmit; fresh, green

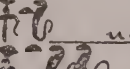

nat, emerald


nat, order, transmit, to grow-faire croître

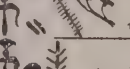

nat, rags, wraps, cotton, linen; a green cotton dress, worn on certain ceremonies

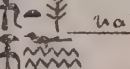
nati, fruit or flower


nat mest, color for the eyes

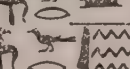

nat, an uraeus

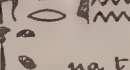
nati, the 'asp crown'

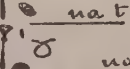

nati, plants

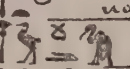

nat, "

nat ur, the great water, the ocean, the Nile, the Mediterranean

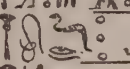

nat ur

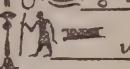


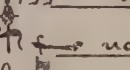

nat, water

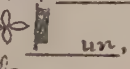

nat t, rags, swathes, wraps

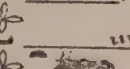
nat mes, color for the eyes


nat mes, " " " "

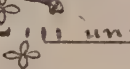

nat nat, " " " "

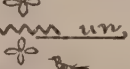

nat ur, the ocean

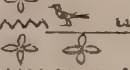

nat, to hold firmly

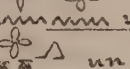

un, to open, open

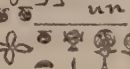
un, a bull, a calf

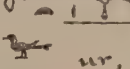

unet, a male, a calf

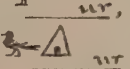

unw, a bull, a mule, young of bovine


un, to appear, to be, to show

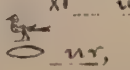

un, defective, wanting


unun, a bird of the Ardea Kind


un, to be, to stand


unet, a mirror

ur, great

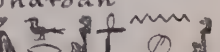

ur abumer, the great pyramid

urh, oil

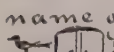
ur, great, principal, old, eldest;

ur Katenlum, the

great seat of Thummis, the throne of Pharoah


ta ur neferṭ

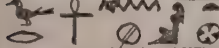
anx, the great goddess of Life, a name of Sexet


ur hebsw, great of feasts, i.e. celebrating many feasts or anniversaries, see next col:

ur, great, principal

ur, elder, great, chief

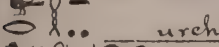
ur, chariot, quadriga

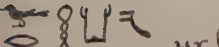

ur anxṭ, a female citizen

urˢ, oil

" ureh kati, uraeus, two uraei

urḥt, oil, anoint


ur ḥekuṭ, a qualification of the Goddesses; frequently applied to the Sexet form of lion-headed Goddesses.


ur ḥekꜣ, the name of the instrument with a ram's head which was used at funeral ceremonies

ur ḥekꜣw, " " " " "

urḫw, oil, to anoint

" , " "

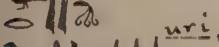
" , " "

uriw, bolls

uriṭ, the inundation

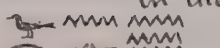
uri, an abundance of hair

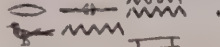
uriṭ, a rose tree


ur mw, the bull Mnevis

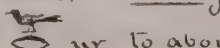
urnes, space, infinite extent, the celestial water firmament

through which the Sun proceeds in the Sacred barge


" " " " "

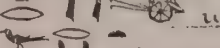

" " " " "

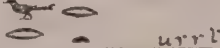
ur ḥeḥti, a high priest


ur, to abound, to have an abundance of -, considerable, important. After an adjective it means, very, much

urriṭ, a chariot

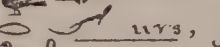
urri, "

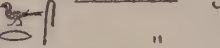

urriṭ, "


urrṭ, the crown with asps

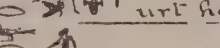
" " "

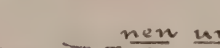
urw, a battlement

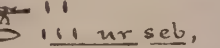

urs, pillow,


" "

urṭ ḥati, peaceable, meek

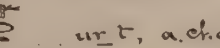

urṭ, abide, dwell, rest, repose, sleep; nen urṭ, not rest, the planets

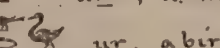

uriṭ ḥati, the heart that does not beat, a name of Osiris relative to his death

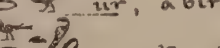

ur seb, Chief of five, chief of a confederation

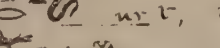
urṭ ḥati, peaceable, meek

urṭ, cease, rest, rest from work.

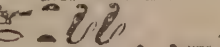

urṭ, a chariot


ur, a bird

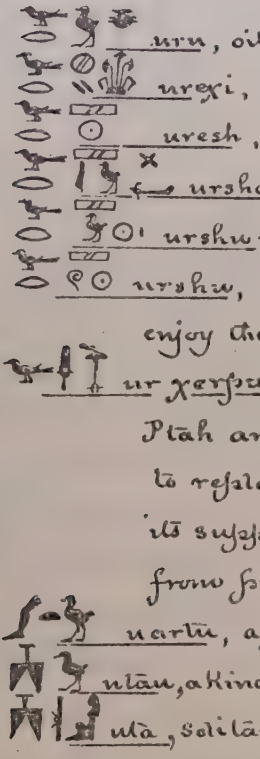

urṭ, the Asp-crown


urṭ, a chariot

urti, the asp-crown


urṭ, a chariot

urtiṭ, the Asp crown



urn, oil, a beverage

urgi, to become green, verdant

uresh, watch, vigil, attentive

urshaw, to watch, to observe

urshurra, an astronomer

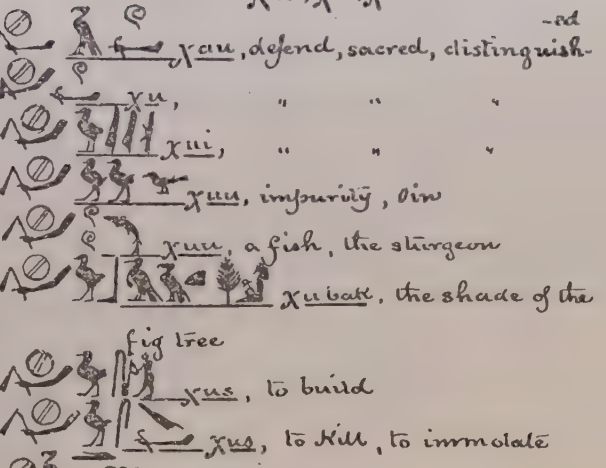
urshw, to occupy the time, to enjoy the time, to pass time

ur Xerfu, the title of a priest of Ptah and Sokari whose duty was to replace the sacred barge on its support, when it was returned from processions

uartu, a footman, a courier

utau, a kind of crane, solitary crane

uta, solitary, separated, divorced



Xau, defend, sacred, distinguished

Xu, " " "

Xui, " " "

Xuu, impurity, sin

Xuu, a fish, the sturgeon

Xubak, the shade of the fig tree

Xus, to build

Xus, to kill, to immolate

Xaker, a plant, a bush

XaXa, to navigate

XaXet, "

Xeb, lowly, laid low

Xeb, Lower Egypt, N. Egypt, a bee

Xeb, error, sin, hypocrisy, violate

Xeb, a hippopotamus

Xeb, to commit an act of violence, to break in with violent intent, to penetrate for devastation

" " " "

" " " "

" " " "

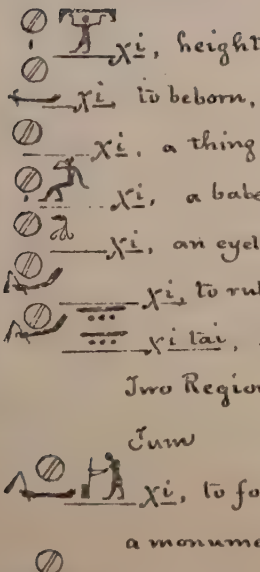
" " " "

Xeb, a soup

Xeb, a title, a name, to change

Xeb, the place of torture, the place of execution the scaffold

X



Xi, height, length

Xi, to be born, to rise, a child

Xi, a thing

Xi, a babe, to be born, to rise, a child

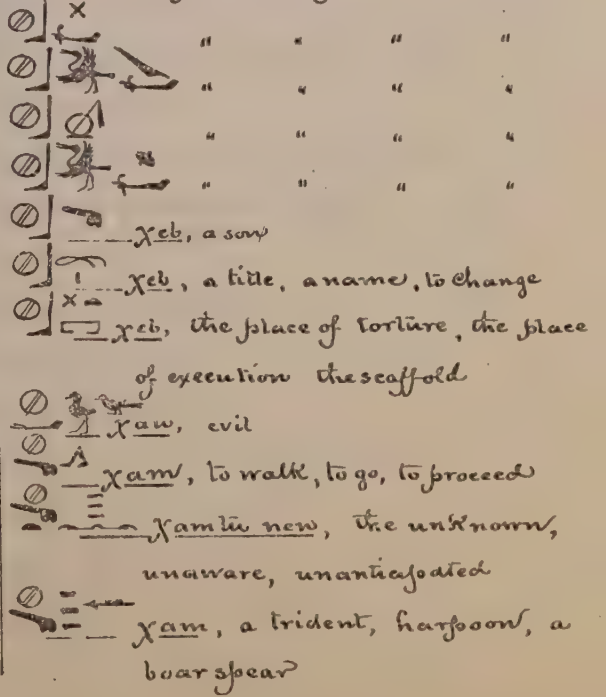
Xi, an eyelash

Xi, to rule, to protect, a fan, a screen

Xi tai, Protector or Director of the Two Regions, a title of the God Nefer Tum

Xi, to found, to construct, to erect a monument

Xi, a passenger boat



Xaw, evil

Xam, to walk, to go, to proceed

Xamtu new, the unknown, unaware, unanticipated

Xam, a trident, harpoon, a boar spear

xeb

xeb, gymnast, acrobat mountebank

xebeb, a vase

xam 1u, three, 3

xam w, desire, pleasure

xeb, change, humble

xeba, less, inferior

xeba, to overthrow, to subdue, to overcome, to vanquish

xebi, cane, reed

xebem or bexem, behemoth, a hippopotamus

hebew, to dig

xeben, falsehood, dishonesty

xebni, iniquity, starve

xeben t, unacceptable to the Gods

xeben t, false, falsehood, dishonesty

hebenti, iniquity

xebes, to labor, to turn over the soil

xebes, a lamp

xebes, a star

xebes, to dig

xebes, some evil place

xebest, lapis lazuli

xebsw, ploughed fields

xebes, to clothe

xebsi, a hoe, a mattock

xebsi ta, ploughed land

xebsit, a hoe, a mattock

xeb, xef

xeb t, error, sin, to lie, deceit

xeb, to divide arithmetically, to divide a field

xebt, to dance

" " "

xebt, block, scaffold

" " "

xebw, execution, death penalty

xebu, to die, to sleep

xebu, the cross of grain

xebxeb, to open

xebxeb, to lay low, to beat, battle

" " " " "

xebxeb, to escape

xebxeb, a vase

xebxeb, to cut, to lay a snare

xeb, a lily-leaf

xeb, to bend, to incline, to salute, to submit

xebeb, a vase

xebs, to fight so as to divide-, to carry off, to extract

xebes, the man who extracts the sap from the balsam tree or plant

" " " " " " "

xef, a bundle, a fragment

xef, to look, to see

xef, to capture

xefa, to capture, to seize, to grasp, a fist

xefi, to look, to see

xefi, the beach, seashore

Xef, Xi

Xefa, to seize, to fix

Xefa, a malefactor

Xef, "

Xef.t, when, if, while, with, as well as, in front of, before, the aspect, the visible part, the front of an edifice, an agreement of date. Xeft her en tā er tēr, before face of earth entire, before the whole world.

Xeft, impure, impurity, enemy, rogue

Xefther, sarcophagus cover

Xef.t her neb sw, the One who faces her Master, the Goddess of the West

Xef.t her, to face towards, facade. Xeft her ek, for thee; Xeft her a before me.

Xef.t, an enemy, an accuser

Xeftā, " " " "

Xef.t, " " " "

Xefw, fruit, or quantity

Xefti, an enemy, an accuser

Xef Xef, to import, to bring

Xi, to be born, to rise, a child

Xi, a child

Xi, height, length, shelter, protection

Xii, the heavens

Xii, highlands

Xii, one of the four supports of the heavens

Xi, Xem

Xit, shelter, protection

Xi, a child

Xiaw, "

Xib, a title

Xii, such an one

Xii, height, length

" " "

Xii.t, the heavens

Xii, to speak loud

Xii.w, the crowd, the vulgar

Xinurw, to disperse, to put aside, to disappear, to carry off, weak, to get lost

Xirukalalā.t, a hill side, a slope, an escarpment

Xinuru, a part of a harness, the reins?

Xi Xi, to beat, to whip

Ximalā, bitterness, privilege right, ceremonies, festivals

Xem, to crush

Xem, no, not, to ignore

Xem, a sanctuary

Xem, the unknown, mysterious

Xemd, overthrow, destroy

" " "

Xem, the unknown, the mysterious

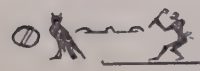
Xem, to break in pieces, to bruise

Xem, a sanctuary

Xem, a shrine, a box

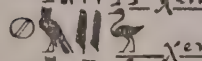
Xema, to bruise, to destroy, to efface

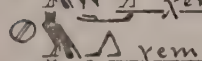
Xem

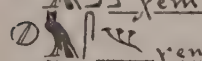

Xem new, the ignorant, the evil, the adversary of the right, he who denies that which is true or good, the enemy

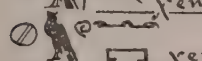
" " " " "

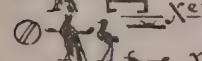
Xemi, " " " "

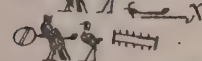

Xemi, a flamingo, a pelican


Xema, to bruise, destroy, efface

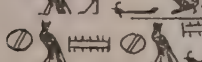

Xemes, an ear of grain

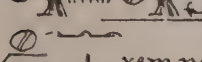

Xemw, a shrine, a prison

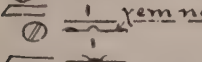

Ximaw, to demolish

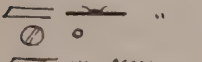

" " ; Ximt, fire, heat

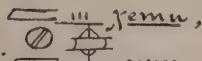
Ximw, a mason's assistant

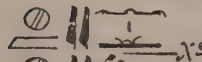

Ximxim, to bruise, crush

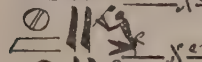

Xem nen, ignorance, weak, small

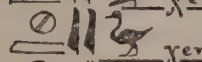

" " " " "

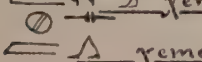

Xemu, the dead


Xem, a difficulty of breathing, the asthma

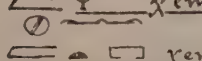

Xemi new, ignorance, small, weak

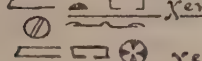

Xemi, crushed, subdued


Xemi, a quail

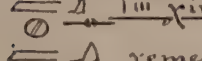

Xemes, to saddle, to proceed

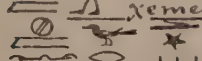
Xem t, a square headed sistrum

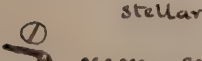

Xem t, a shrine

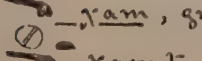

Xem, "

Ximw nifw, foul winds


Xemes, to work a boat


Ximw urt w, the great stellar Gods

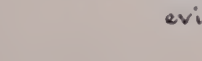

Xam, grace, favor

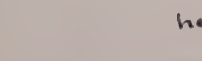

Xamt, three, 3

Xam, Xew

Xamt, three, 3, favor, besides, grace

Xamt, care, wish, exception


Xamt, favor, grace, three, 3


Xamtu, to oppose, to deny

Xen, weak, sick

Xen, an act of offering

Xen, to conduct, to transport

Xen, a little

Xen, to arrive, to enter, to penetrate,

Xen, to cry out with joy

Xen, inside

Xena, to refuse, to repel

Xena, to blow, to puff away, to avert

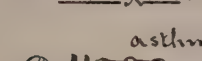
" " " " "

Xena, the aggregate of buildings & grounds attached to the Pharoah's residence

Xenam, to blow away, to snuff-, to inspire, to avert

Xenar, " " " " "

Xena, to shut up, to imprison


Xenan " " " " "

Xeneb, prostration

Xenef, food or bread offered to the

Xenefw, deads

Xeni, to cry out with joy

Xenem, a fine stone, jasper

Xenem, carnelian

Xenem, jasper, carnelian, porphyry

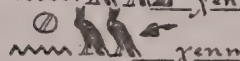
Xenend, to nourish

Xenenw, to be drowsy

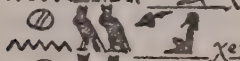
Xenenw, brass

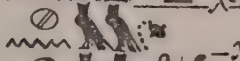
xenmens } nurse, educator,
" governess

xenmens, girl, woman, courtesan

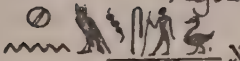

xenmew, odor, to smell, to choose, to select

xenmew, to sleep

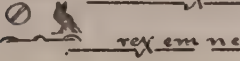

xenmew, a governor

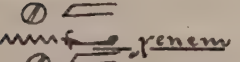

xenmew, an odor, to smell

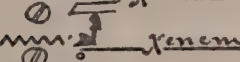
xenmems, an uncle: the term was generally affixed to an aged relation or friend whose advice should be listened to respectfully

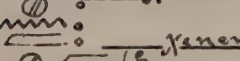

xenems, ? goose, gnat, mosquito

xenemw, a nurse.

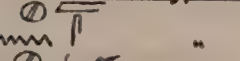

rexemnen, Know nothing, to ignore, not to know


xenew, to smell


xenew, a nurse


xenew, brass

xenemw, a relationship, a tutor


" " " "

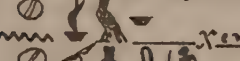
xen, to smell, an odor

xenew, " "

xenem, to perceive

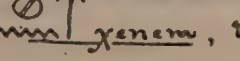
xenew, to unite, to join

xenems, a title, function, tutor


xenmew, a kind of food, basket

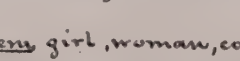
xenems, a title, a tutor, function

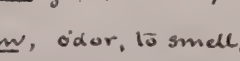
xenemw, " " "

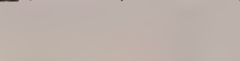

xenem, to shut up, to imprison

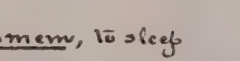
xenmew, a shrine, a granary

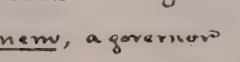
xenew, to quarrel, to make war, a scourge, a disaster, revolt

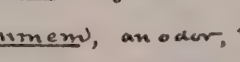

" " " " " " "

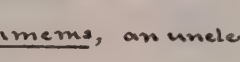

xenew, violent, adverse, scourge, disaster

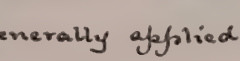

xeneni enpet, calamity

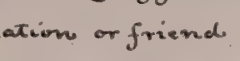

xeneny, agitate, alight, rest, stop

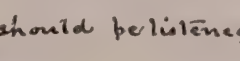

xenew, to fly, to lean on

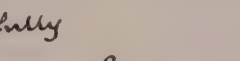

xenew, to hover, to soar, to float, to alight, to rest

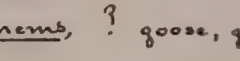

xennaw, a part of the body, the lungs, the stomach

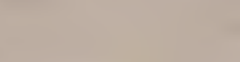

xenni, to transport, to conduct, an evil, a scourge

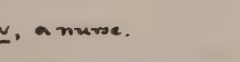

xenep, to present, to offer, to carry off, to take away

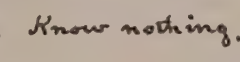

xennw, some part of the body

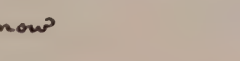

xennr, a limb

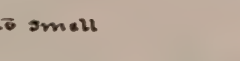

xennw, a sanctuary

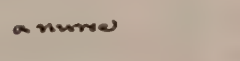

xennw, intelligence, news


xennw, to conduct, to transport, to arrive, to enter

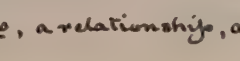

xennw, a concubine; a dwelling


xennw, to cry out with joy,

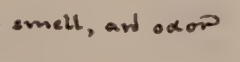

xennw, a sacred title


xenr, a recluse, a woman of the harem

xennw, to stop, to stand


xenen r, a sacerdotal title

xenrw, to imprison


xenep, a name of the inundation

xeneraw, a concubine

xew

xenesh, to throw out, to tear out, to extract, express

xener, weak, sick, feeble

xener, skin, leather, cuirass, harness,

xenrw, a horse, a charger

" " "

xensait, tamarisk

xensw, to putrify

xéns, to hunt, to pass through

" " " "

xensw, to penetrate, to pass in or out, to pass through

xens, to hunt, to fowl

xens heb, a festival

xent, to penetrate, to tread upon, to mount

xent, to penetrate, to tread upon, to frequent

xent, to penetrate, to tread upon

xent, entrance, staircase, throne

xent, one who had charge of a child's education

xenti, a crocodile

" "

xentu, to penetrate, to tread upon

xentu, a statue

xentu, a phalanquin

xentesh, a garden

xen t, clay, mud

xen t, joy, delight, to be delighted, enchanted

xew

111 xen t, quantity, the circumstances attending a festival, order, condition

xenti, a workwoman, a weaver

xen t, to approach

xen t, a garden

" "

xen t, to pour out

xenti, the legs

xenw, to seek a palace of repose

xenti, an image

xent, to go ahead, to mount

xent, to rest, to repose

xenoh, stinking, base, vile

xen, something to be subtracted, minus, less

xensh, to stink, something repugnant

xenesh, to pour out, to consecrate

xen, a child, a baby

xenesh, an animal offered for sacrifice

xenesh, is said of animals offered for sacrifice

xen, weak, sick, refused

xen, to support, to alight

xennenw, smell

xenew, a child, a baby

xentesh, a pool, a garden

xent, the pshent or double crown of Upper and Lower Egypt

Xesp

Xesp, a foot;
Xesp, when, a duck or goose

" "

Xesp, a thigh a hind quarter

Xesp, to depart, to evacuate

Xesp, a pace, to move, transport, to follow a road

Xespew, to fatten geese,

Xesp, t, a pace, to move, to transport, to follow a road

Xespti, ossprobrium

Xespw, "

Xesp, a blot

Xespet, to creep, to crawl, to be stretched on the ground, to prostrate oneself

Xespesh, a hind quarter

Xespesh, Constellation of the Great Bear

Xespekr, force, power

Xespesh, the royal sword

Xesp, to create

Xesp, to transform, create, occur

Xespef, the hold of a boat

Xespi, harvest

Xepi, a scarabaeus

Xepni, ?

Xepnew, a kind of fish

Xeper, a form, a shape

Xeper, scarabaeus, transform, generate, occur

Xeper, Creator-God, transform, scarabaeus

Xeperri, a scarabaeus

Xepet, a thigh, a hind quarter

Xer

Xeptshi, sword

Xer, to, at, under, like, towards, in regard, in respect to -, but, when. Xer is generally a ligature and adds but little to the sense or meaning; it also expresses the sense of now then, so then, since, certainly when it is necessary: id:

Xer, to overthrow

Xer, to fall

Xer, that which charms, pleases

Xer, cell, shrine, burial ground

Xer, a boat for processions

Xer, a strong loud voice, cries, yells

Xer, a bull for sacrifice

Xer, a strong loud voice, cries, yells

Xer, to speak;
Xerra, action, act, fact.

Xera, myrrh.
Xer ar, after

Xer art, a quiver

Xeri, a funereal chamber

Xeri, to protect, to take care of

Xeri, defeated

Xeri u, the lungs

Xeri, a cow

Xeri, victim, fallen, defeated

" " " "

Xer bu rex a pehu, I did not know how to reach it, i.e. I was not able to do it

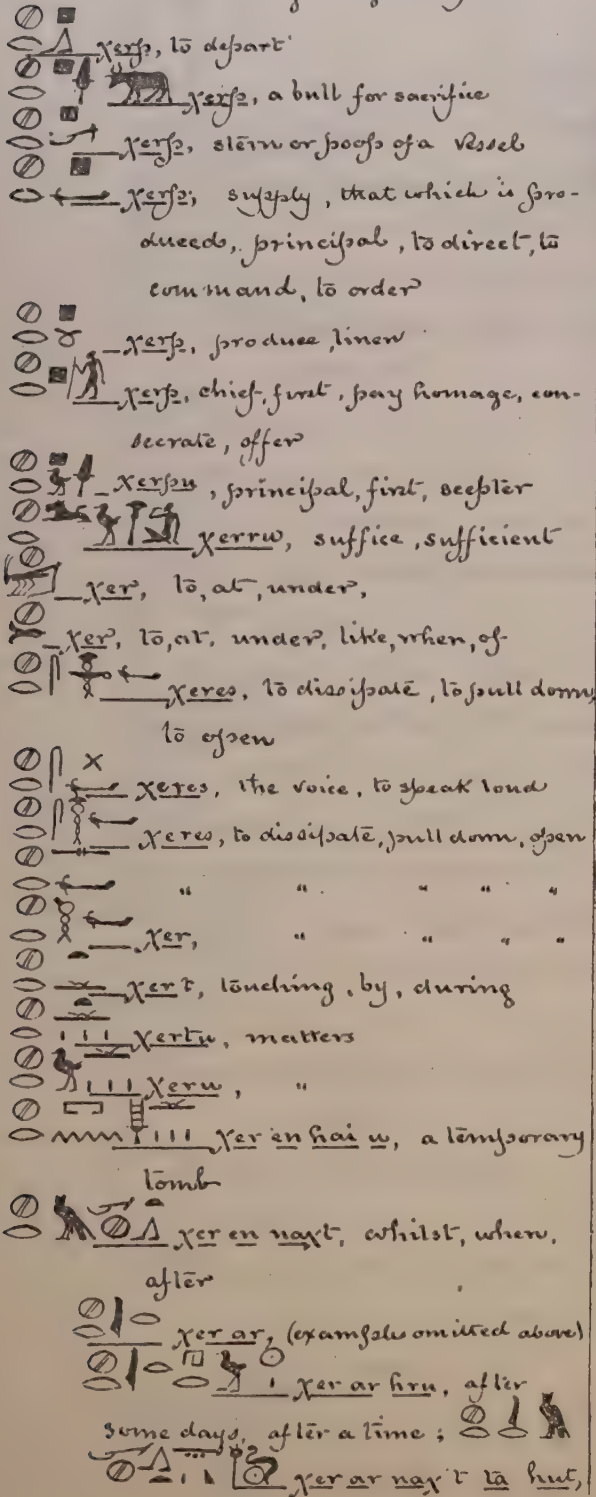
Xerpe, to surpass, to beat the head of- see infra

" " " " "

Xerp, to offer, to render homage, to

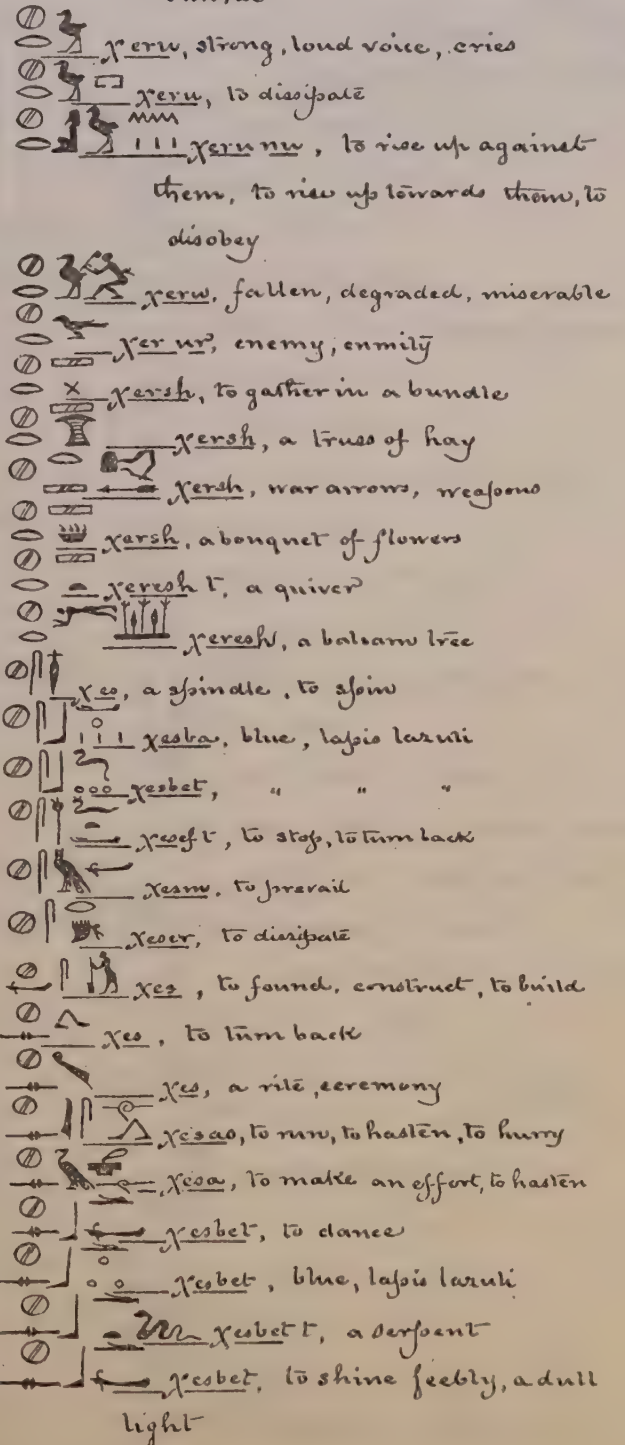
Xer

submit, to apply oneself to a matter, to do a thing energetically


xerp, to depart
xerp, a bull for sacrifice
xerp, stern or poops of a vessel
xerp, supply, that which is produced, principal, to direct, to command, to order
xerp, produce, increase
xerp, chief, first, pay homage, consecrate, offer
xerpu, principal, first, sceptre
xerru, suffice, sufficient
xer, to, at, under,
xer, to, at, under, like, when, of
xeres, to dissipate, to pull down, to open
xeres, the voice, to speak loud
xeres, to dissipate, pull down, open
" " " " "
xer, " " " "
xert, touching, by, during
xertu, matters
xeru, "
xer en hai w, a temporary tomb
xer en nayt, whilst, when, after
xer ar, (examples omitted above)
xer ar hru, after some days, after a time;
xer ar nayt ta hut,

Xer, Xes

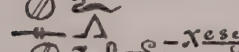
when white the earth was lighted, after the earth was illumined, after sunrise

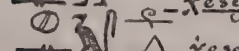

xeru, strong, loud voice, cries
xeru, to dissipate
xeru nu, to rise up against them, to rise up towards them, to disobey
xeru, fallen, degraded, miserable
xer ur, enemy, enmity
xersh, to gather in a bundle
xersh, a truss of hay
xersh, war arrows, weapons
xersh, a bouquet of flowers
xereshet, a quiver
xereshu, a balsam tree
xes, a spindle, to spin
xesba, blue, lapis lazuli
xesbet, " " "
xesefet, to stop, to turn back
xesnu, to prevail
xeser, to dissipate
xes, to found, construct, to build
xes, to turn back
xes, a rite, ceremony
xesaa, to run, to hasten, to hurry
xesaa, to make an effort, to hasten
xesbet, to dance
xesbet, blue, lapis lazuli
xesbet, a serpent
xesbet, to shine feebly, a dull light

xes, xet

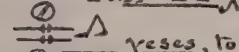
xesef, to avoid, to put aside, to repulse, to oppose

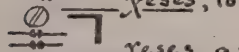
" " " " "

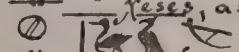

xesef to stop, to turn back

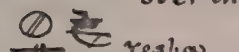

xesau, to run, to hasten

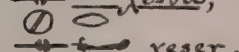
xesemu, a sanctuary

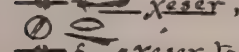

xeses, to run, to hasten

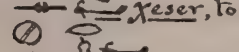

xeses, a square, a corner, an angle

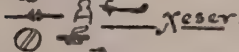

xesba, to labor, to turn over the soil


xesbaw, " " " "

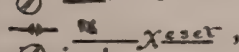

xeser, to dissipate

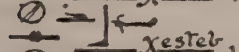

xeser, to dissipate, immolate, disperse

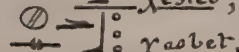

xeser, to dissipate, to clear

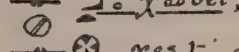

xesai, vile

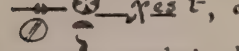
xeset, foul, choke

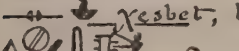

xestef, to shine feebly, a dull light


xasbet, blue, lapis lazuli

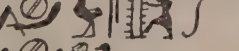

xest, a district


xesbet, blue, lapis lazuli


xus, to found, to build, to construct, to pound, to ram

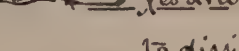

xuu, sin

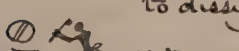
xeoarw, to immolate, to ruin to dissipate


xet, accuser, enemy

xet, to go

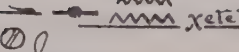
xet, a passenger boat, to navigate, to go with the current to the northward

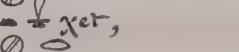

xet, a port, a ford

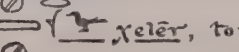

xetet, beyond

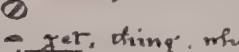
xet

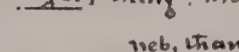
xetet, beyond, besides

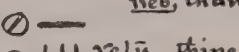

xet, " "

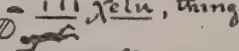

xeter, to vex, to annoy

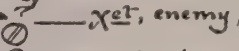

xet, thing, whit, breadth; er xet neb, than things all, everything

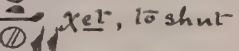

xetu, things, offerings, riches

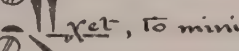

xet, enemy, accuser

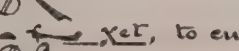

xet, to shut

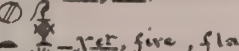

xet, to minister

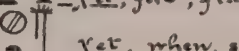

xet, to cut, to break in pieces

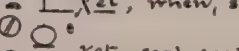

xet, fire, flame

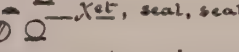

xet, when, step

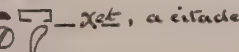

xet, seal, sealed, to close, closed

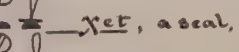

xet, a citadel

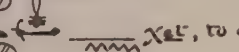

xet, a seal, stop, when


xet, to close

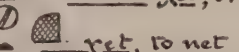

xet, bridge, lake, follow a current

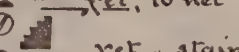

xet, to net

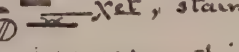

xet, stairs, a seat

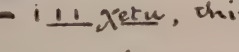

xetu, things, matters, ceremonies, rites, cult, a worship, religion

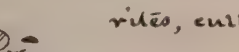
xet, matters of science

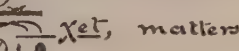

xet u neter, the God of matters, of things

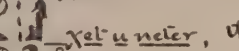

xet Har, nitre

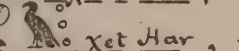

xeta, a seat, stairs, steps

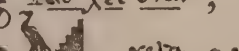

xetet, the fallen; id.

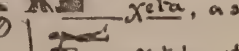

xetet, to dance


" "

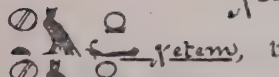

xetef, an embalmer

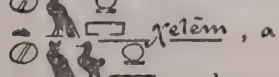

xeti, a child


xeti, the apex of an obelisk

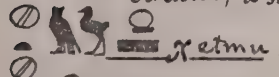

xetmaw, a lake, a pond

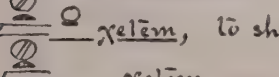
xet, xw


xetem, to shut, close, seal

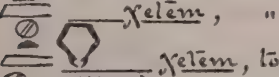

xelēm, a citadel, a fortress

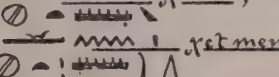
xetmw, to lock, a fortress, a citadel, a stronghold, a dungeon


xetmu, to seal

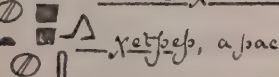

xelēm, to shut, to close

xelēm, " "

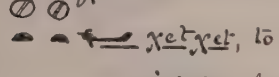

xelēm, to enclose, to close, surround

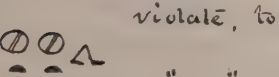

xetmew, the earth, the world

xet u menlā, " " "


xetsefs, a space, to space

xus, to terminate, to finish, to close


xetxet, to break, to smash, to violate, to overthrow, to reverse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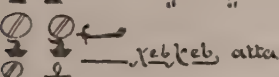
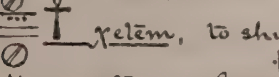
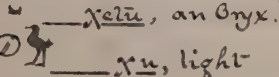
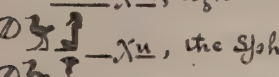
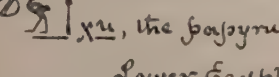
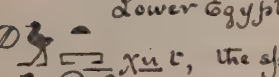

xebxeb, attack, overthrow, reverse

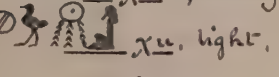

xelēm, to shut, to close

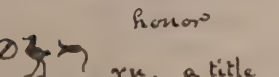

xelū, an Oryx

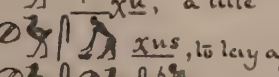

xu, light


xu, the Sphynx

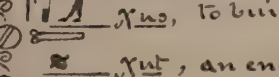

xu, the papyrus sceptre, emblem of Lower Egypt

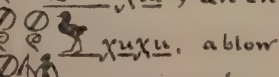

xut, the splendid abode, the tomb

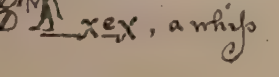

xu, light, brilliancy, splendor, honor


xu, a title

xus, to lay a foundation, to found


xusxus, to build

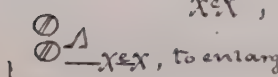

xus, to build

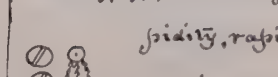

xut, an enemy, an accuser

xuxu, a blow, beaten, to beat

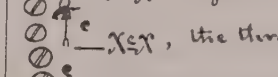
xex, a whip

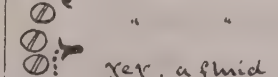
xex, xu


xex, to enlarge, to elongate, to extend, rapidity, rapid, agile of arm or leg

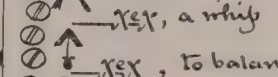

xex, light

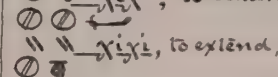
xex, the throat

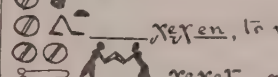

" " "

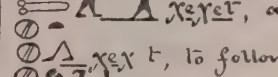

xex, a fluid

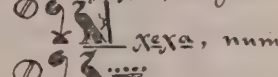
xex, a whip

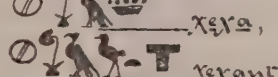

xex, to balance

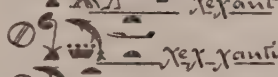

xixi, to extend, enlarge, elongate, agile, rapid

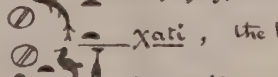

xexen, to resolve, to return

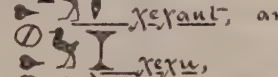

xexet, athletes, wrestlers

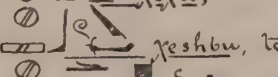

xex t, to follow, to return

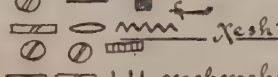

xexa, number, reckoning

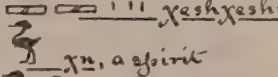

xexa, an altar

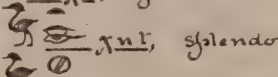

xexaut, "

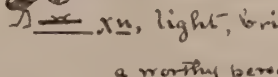

xex-xaui, "

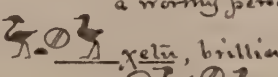

xati, the body

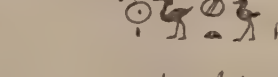

xexaut, an altar

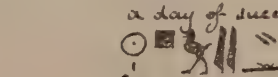

xexu, " , the uraeus


xeshbu, to push, to house by force

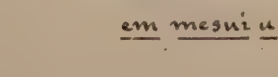

xesheresben, a (Persian) satrap


xeshxeshw, tiles


xu, a spirit


xut, splendor

xu, light, brilliancy, splendor, honor, a worthy person


xelū, brilliant, triumph, glorious;

hru xexlū, a brilliant day, a day of success, a day of victory.

hru pui xulū em mesui u beshiiu, This is a day of

ḫw,

triumph for the evil ones

ḫw, abortive

ḫw, lively, gay

ḫw, light

ḫw w, the dead, spirits

ḫw, spirit, light, illustrious, splendid, honorable, virtuous

ḫw, the horizon

ḫw, sustenance

ḫwt, shine, splace

ḫwt, a spirit

ḫwt, the edge, the horizon

" " " light, fire

ḫw, light

ḫw, to illuminate

ḫw, spirit, manes

ḫw, illuminated

ḫwt w, personed merit, worth

ḫwt w, ceremonies, rites

ḫw, light, brilliancy, splendor, honors

ḫwtj, doubly splendid

ḫw, light, brilliancy, splendor, honors

ḫw, mennw, a quarter of Karnak

ḫwt, the horizon

ḫwtā, adjudged

ḫeb, lie, deceit

ḫwt, the splendid (name of a pyramid), glorious, triumph

ḫw, the dead, the illuminated, the enlightened

ḫw, food

ḫw, light

ḫw, ḫa

ḫw, domain

ḫw, to illumine

ḫw, honor

ḫw, to adore

ḫwt, light, illumine, honor

aḫwt, horizon

afat, the first, commence, begin

ashw, many;
ma ashw, how many!

ma ashw sen w, as many of them as there are

ḫat, a body, the body, a corpse

ḫat, a body, a cadaver, a corpse,

ḫa, carnage

ḫa, a body, a corpse

ḫab, a rib

ḫab, error, sin

ḫa a corpse

ḫabw, a suckle

ḫabw, a fraud, a lie

ḫabw, the throat

ḫakn hatj stupid, obstinate, mad

" " } impious, enemy

ḫat, a corpse

ḫar, a widow

ḫa t, a corpse

ḫat, a quarry, a mine

ḫat, fish pond

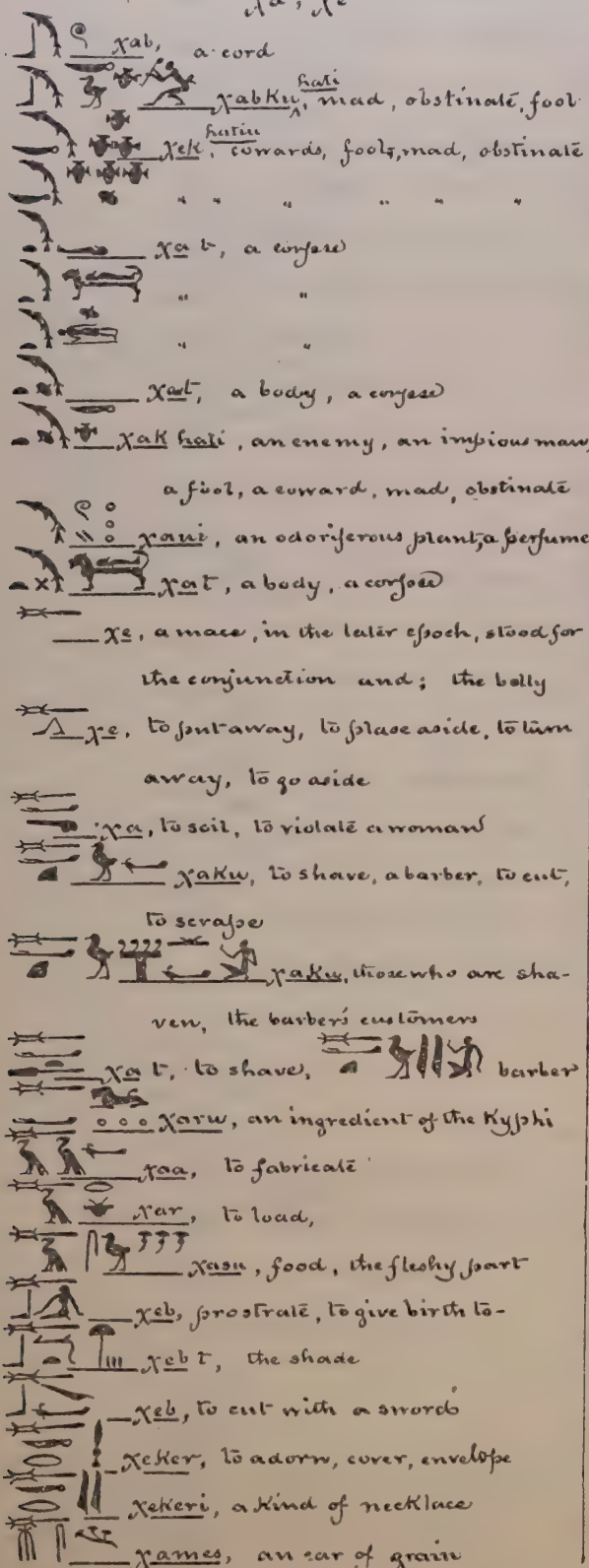
ḫaw t, a quarry a mine

ḫa ḫa, the 5th hour of the day, (at bd. foot)

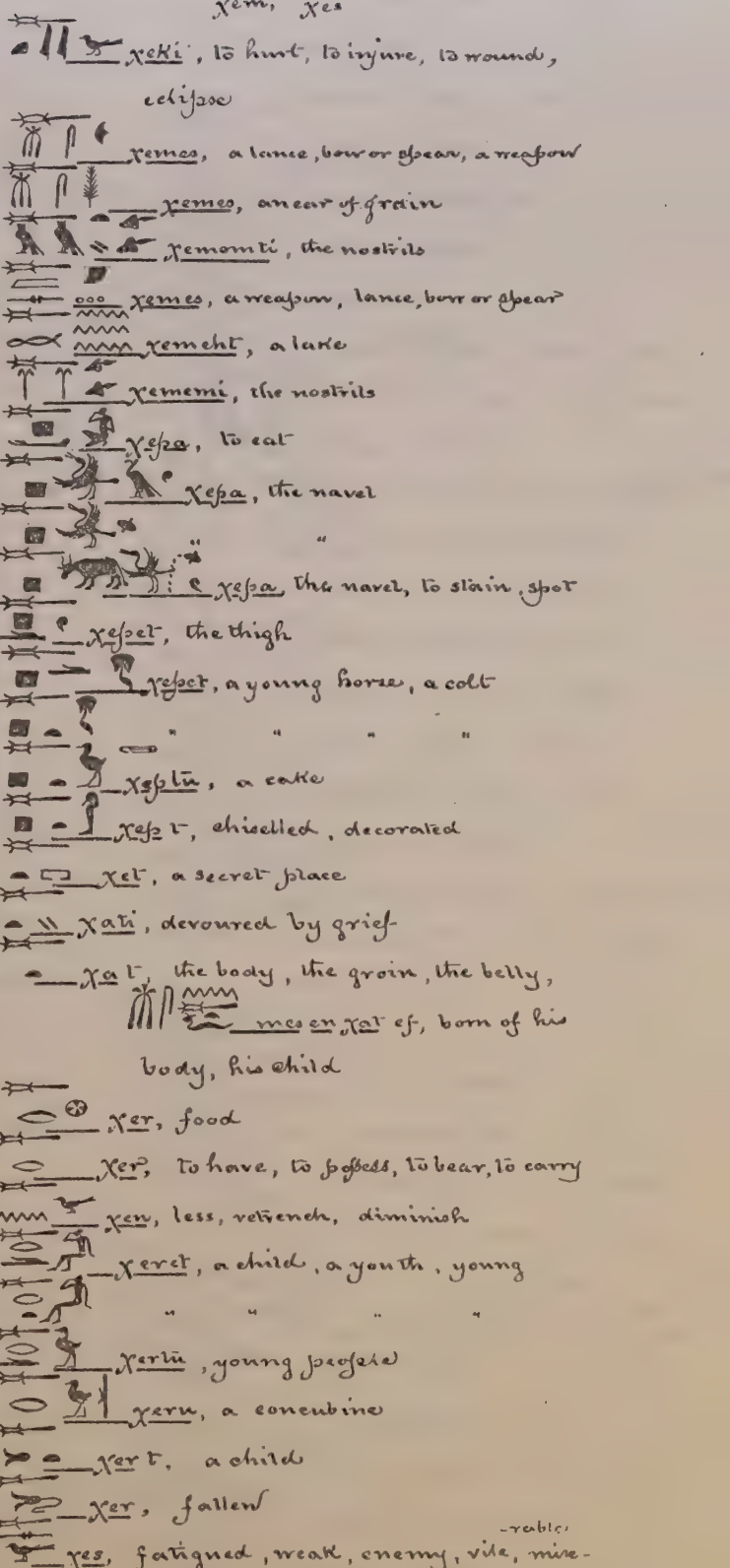
ḫa ḫalā, to wound, to injure

ḫabi, hypocrisy, a lie

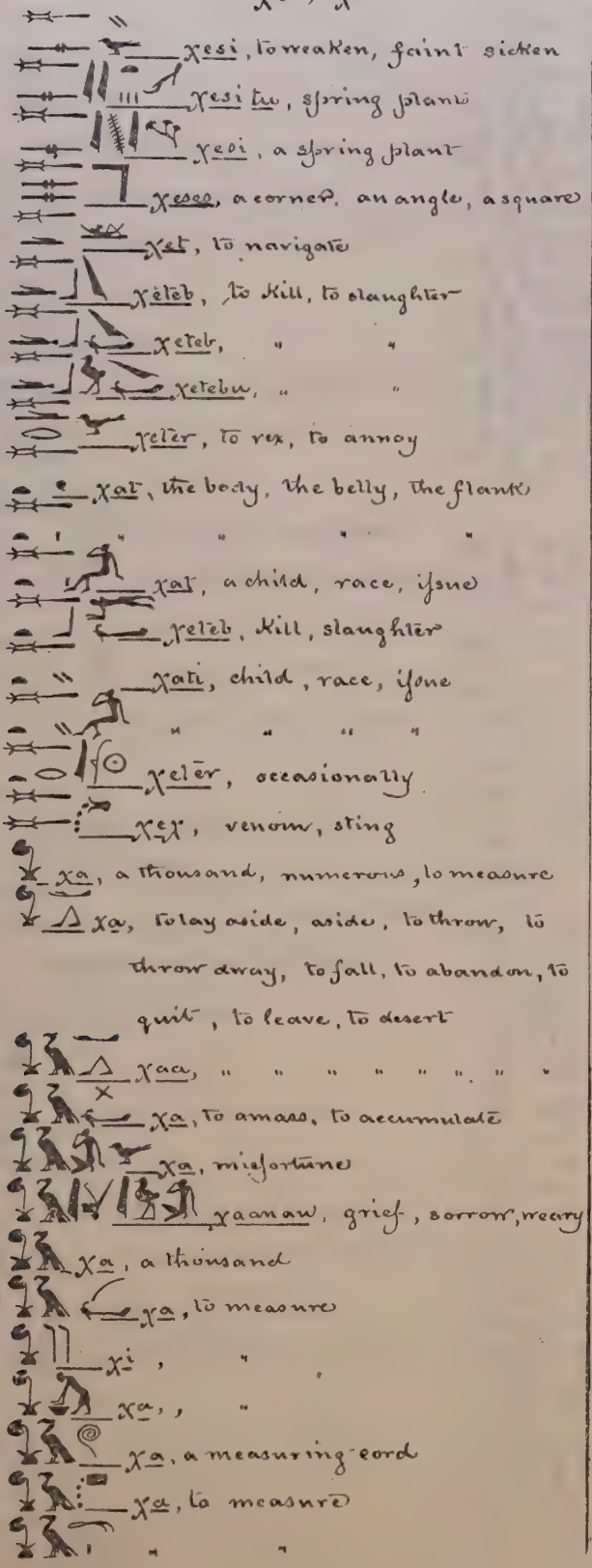
xa, xe


xab, a cord
xabKu, hati mad, obstinate, fool
xek, hatiu cowards, fools, mad, obstinate
" " " " " "
xa t, a corpse
" "
" "
xat, a body, a corpse
xaK hati, an enemy, an impious man, a fool, a coward, mad, obstinate
xani, an odoriferous plant, a perfume
xat, a body, a corpse
xe, a mace, in the later epoch, stood for the conjunction and; the belly
xe, to put away, to place aside, to turn away, to go aside
xa, to soil, to violate a woman
xaKu, to shave, a barber, to cut, to scrape
xaKu, those who are shaven, the barber's customers
xa t, to shave, barber
xaru, an ingredient of the Kyphi
xaa, to fabricate
xar, to load,
xasu, food, the fleshy part
xeb, prostrate, to give birth to
xeb t, the shade
xeb, to cut with a sword
xeKer, to adorn, cover, envelope
xeKeri, a kind of necklace
xames, an ear of grain

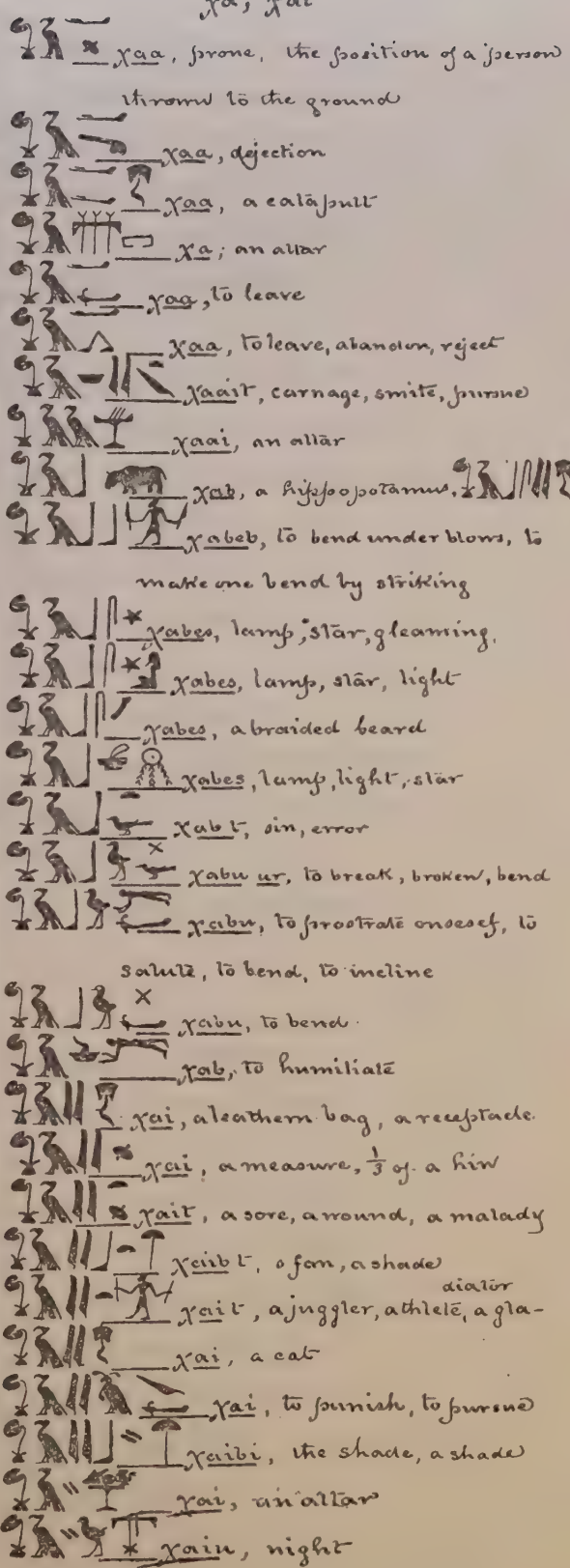
xem, xes


xeKi, to hurt, to injure, to wound, eclipse
xemes, a lance, bow or spear, a weapon
xemes, an ear of grain
xemonti, the nostrils
xemes, a weapon, lance, bow or spear
xemeht, a lake
xememi, the nostrils
xesa, to eat
xesa, the navel
" "
xesa, the navel, to slain, spot
xesset, the thigh
xeset, a young horse, a colt
" " " "
xsplu, a cake
xesu t, chiselled, decorated
xet, a secret place
xatu, devoured by grief
xa t, the body, the groin, the belly,
mes en xat ef, born of his body, his child
xer, food
xer, to have, to possess, to bear, to carry
xen, less, retrench, diminish
xeret, a child, a youth, young
" " " "
xerlu, young people
xeru, a concubine
xer t, a child
xer, fallen
xes, fatigued, weak, enemy, vile, miserable,

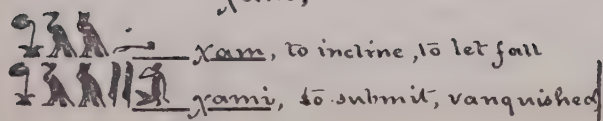
xeī, xa


xesi, to weaken, faint sicken
xesi tu, spring plant
xesi, a spring plant
xesee, a corner, an angle, a square
xet, to navigate
xeleb, to kill, to slaughter
xeteb, " "
xetebu, " "
xelēr, to vex, to annoy
xat, the body, the belly, the flank
" " " "
xat, a child, race, issue
xeleb, kill, slaughter
xati, child, race, issue
" " " "
xelēr, occasionally
x-x, venom, sting
xa, a thousand, numerous, to measure
xa, to lay aside, aside, to throw, to
throw away, to fall, to abandon, to
quit, to leave, to desert
xaa, " " " " " " " "
xa, to amass, to accumulate
xa, misfortune
xaanaw, grief, sorrow, weary
xa, a thousand
xa, to measure
xi, "
xa, "
xa, a measuring cord
xa, to measure
" "

xa, xai

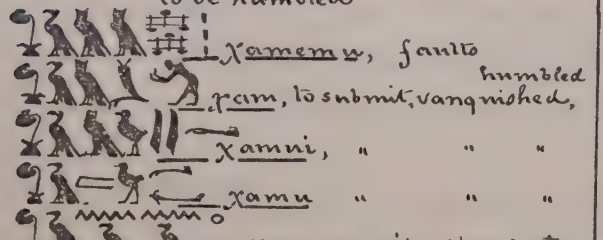

xaa, prone, the position of a person
thrown to the ground
xaa, dejection
xaa, a calabash
xa, an altar
xaa, to leave
xaa, to leave, abandon, reject
xaair, carnage, smite, pursue
xaai, an altar
xab, a hippopotamus
xabeb, to bend under blows, to
make one bend by striking
xabes, lamp, star, gleaming
xabes, lamp, star, light
xabes, a braided beard
xabes, lamp, light, star
xabt, sin, error
xabu ur, to break, broken, bend
xabu, to prostrate oneself, to
salute, to bend, to incline
xabu, to bend
xab, to humiliate
xai, a leathern bag, a receptacle
xai, a measure, 1/3 of a hin
xait, a sore, a wound, a malady
xeibt, a fan, a shade
xait, a juggler, athlete, a gla-
diator
xai, a cat
xai, to punish, to pursue
xaibi, the shade, a shade
xai, an altar
xain, night

xam,


xam, to incline, to let fall

xami, to submit, vanquished

to be humbled


xamemw, faults humbled

xam, to submit, vanquished,

xamni, " " "

xamu " " "

xanana, pips, kernel, the hard rind of the cocoanut

xanini, " " " "

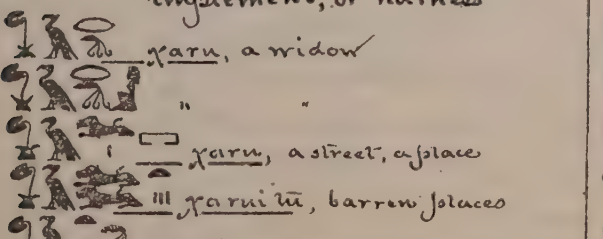
xaminw, to carry away

xanurw, to paralyse, block up, to disperse, to annihilate

xannrw, to confuse, an infirmity of the voice, hoarse, dumb

xanurw, to paralyse, to anihilate

xaenrw, an agricultural implement, or harness


xaru, a widow

" "

xaru, a street, a place

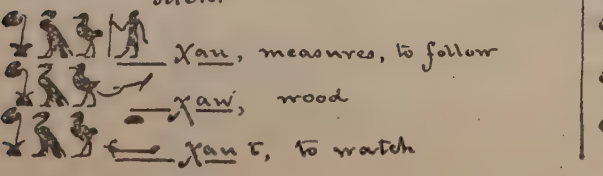
xarui tu, barren places

xati, devoured by grief

xas, to run, to hasten, to hurry

xatet, to kill

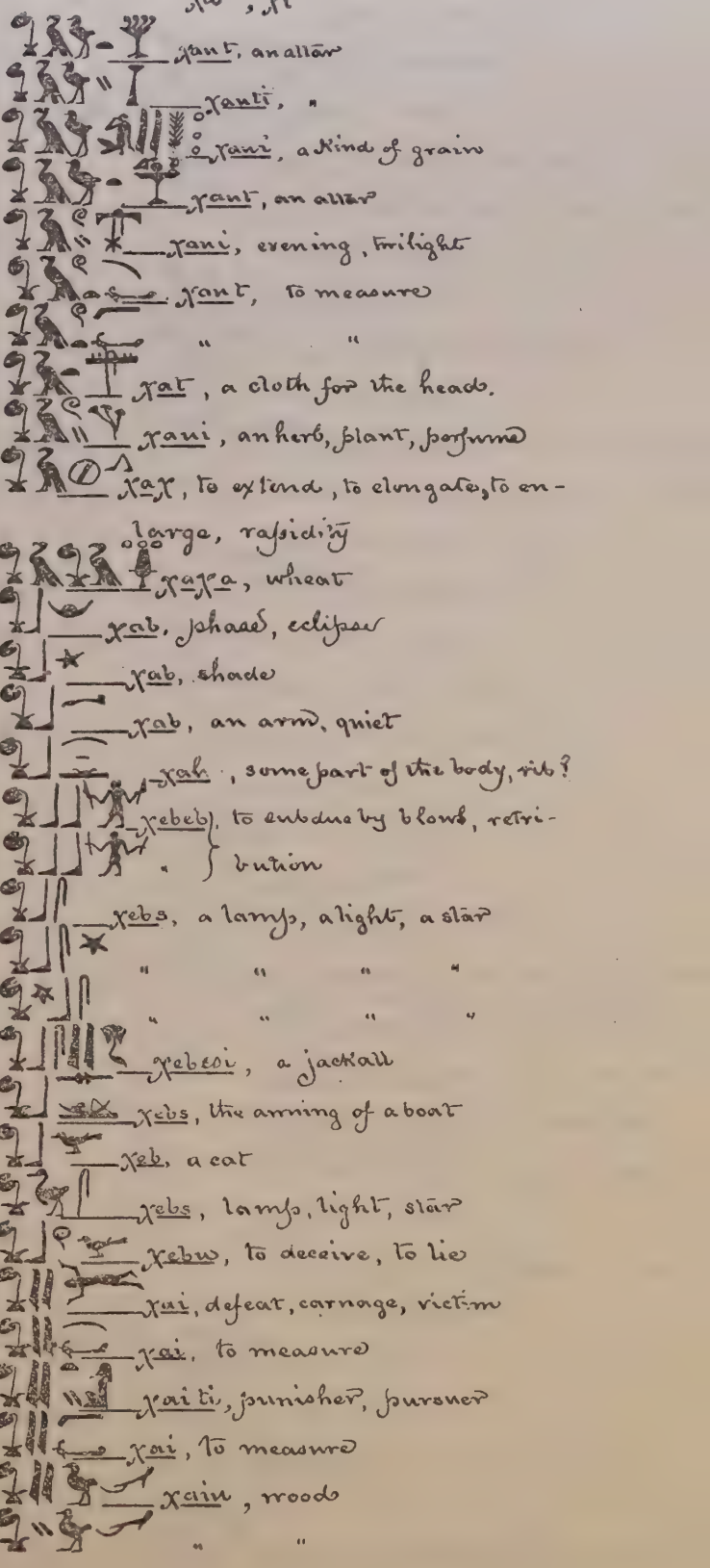
xati, the punishers, the pursuers.


xau, measures, to follow

xaw, wood

xaut, to watch

xa , xi


xaut, an altar

xauti, "

xani, a kind of grain

xaut, an altar

xani, evening, twilight

xaut, to measure

" "

xat, a cloth for the heads.

xani, an herb, plant, perfume

xax, to extend, to elongate, to enlarge, rapidity

xaxa, wheat

xab, shaded, eclipse

xab, shade

xab, an arm, quiet

xah, some part of the body, rib?

xebeb, to subdue by blows, retribution

xebs, a lamp, a light, a star

" " " "

" " " "

xebesi, a jackall

xebs, the awning of a boat

xeb, a cat

xebs, lamp, light, star

xebw, to deceive, to lie

xai, defeat, carnage, victim

xai, to measure

xaiti, punisher, pursuer

xai, to measure

xain, wood

" "

Xem, Xiw

xiw, an altar

xema, to transfer, to render up

xem, to transfer

xemui, to drop, to let fall

shena, to turn back, to turn away

xemen t, a kernel, pith, pulp, the hard rind of the cocoanut

xennu, to encircle, to enclose

xenrw, to annihilate, to paralyse

xenrw, a horse

xenurw, to block up a road, to disperse, to annihilate, to paralyse

perenspa, college of the sacred writers

shena, to turn away

shena to turn away

shenti, to blaspheme, to slander

xat, an altar

xentesh, to sprinkle

xenta, a quantity of land

xas, to run, to hasten, to hurry

xas, mountainous land

xa sa, negligent, delinquent

xat, overcome by grief

xa ta, land's end

xata xata, to crush

xa ta, a measure or quantity of land

xa, evening

xan, an altar

" " "

Xaw, Xet

xani, an altar

xant, wood

xani, an herb, a perfume

xaxa, to extend, to elongate, to enlarge, rapidly

xaxa, wheat

xabs, a lamp, a light, a star

xab, an altar

xeb, to fall, to prostrate oneself

xa, wood, a stick, a sceptre, a six foot measure

xa shetw, ?

xet, a tree or bush

xem, matter, body

xen, a kind of wood

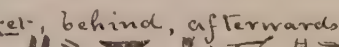
xet, wood

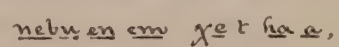
xet, a tree, wood

xeti, to cut

xet xet, to recoil

xet, behind, afterwards, while, when;


ei nebw en em xe t ha e, all who come after my time (duration).


ar em xe t renpit, after the year-

To go after, to follow, pursuit, to overwhelm

xeti, " " " "

xet, wood

xet, to cut, to engrave

" " "

xet, the weight of a plumb line, or

xet, xem, xes

of a steelyard

xet, land which has lain fallow for one hundred years

xeti, " " " "

" " " " "

xet, to recoil, to go backwards

xet xet, to go forward and backwards, to go to and fro, to seek

sxem, a sceptre

sxem, a people

sxem, an order, will, pleasure

sxem, an image, a likeness

" " "

xems, to prevail, master, possessor, the powerful, to dominate

xem hati, oppressor, the violent hearted, the sad hearted

xemw, to prevail, master, possessor, the powerful, dominate

xem, " " " "

" " " " "

xemw, " " "

xem t, a domain

xeti, the double crown, p'shent

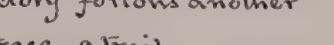
xesef, to repulse, prevent, force back

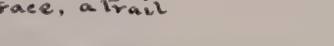
xesef (Kab), a repulse (by the arm), the arm in this case is only an ideogram, as in Kar, a combat (of the arm), a melee, defeat, a rout of the

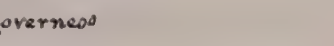
xes, xen

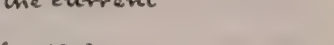
enemy;

xesef na her ti sen ef one victory takes its seconds, 'one victory follows another'


xesef, to trace, a trail

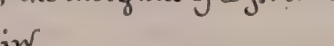

xemt, a governess

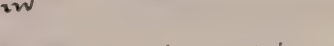

xesef, to ascend the river going against the current

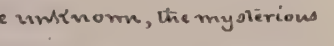

xesef, to protect

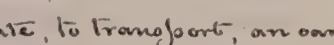
xu, a fly flap, the insignia of a prince

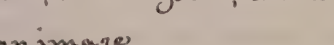
xu, a domain

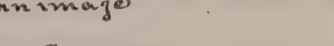
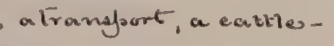

xem, the unknown, the mysterious

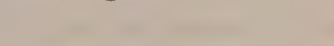

xen, to navigate, to transport, an oarsman, an image

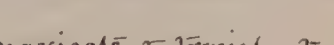

xenit, a transport, a cattle-boat

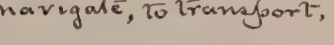

xen, to navigate, to transport, to carry, to despatch a boat or a vessel


xeni tw, conveyors, sailors


xenew, to quarrel, to make war, to revolt, a scourge, a disaster. The mephitic winds of Egypt, which carried contagion, were characterised by the groups  em nisu xenww, the fatal winds


" " " blind rage

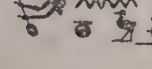

xenen, (the same as the preceeding,) contention, quarrel, revolt, scourge, disaster &c

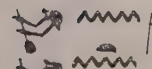

xeneni, " " " "

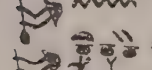
xenen, to transport, convey

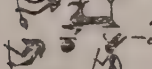
xen, to transport, adverse, to contend

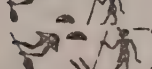
xennw, to navigate, to pilot

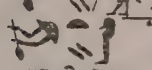

xennw, to navigate, to convey, to faut

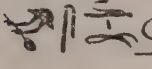

xent, a statue, an image

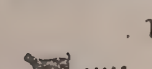

xenti, " "

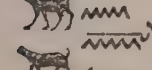

xennw, see

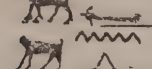

xent, a statue, an image


xenti " " "

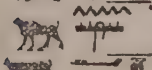

" " " "

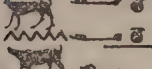

xenslut, a garland, a chaplet, a circlet


xen, to approach, arrive, enter


xen, to conduct

xen, to conduct, approach, enter

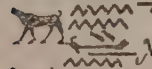

xen, a skin, a cover

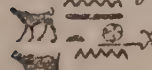

xen, within

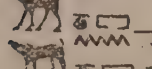
xenau, a liquid

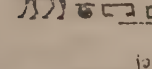
xen or shen, something to be subtracted, less, minus

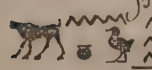
xent, the inside, interior

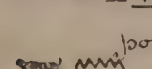

xenew, to conduct, to transport

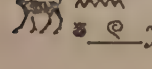

xeneni, fatal, woeful violent


xent, upper Egypt

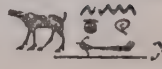

xennw, a hall, within, interior

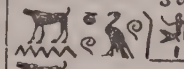

xennw, interior, a central apartment

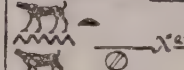

xennw, a lake, a pool, a pond

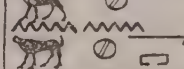

xennu, the aggregate of buildings

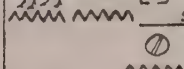
and lands attached to Pharoah's residence

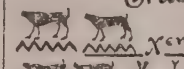

xennw, to cease; new xennw, without ceasing, incessantly

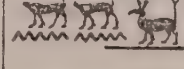

xennaw, people of the interior


xent, interior, inside

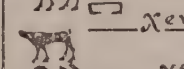

xenxen, Upper Egypt

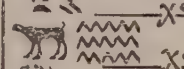

shenxen, central; , hesaptu shenxen, the central nomes between Lower Egypt and Nubia

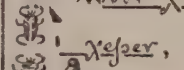

xenxen, to spring forward, to dart

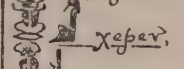

xenxen, to conduct, to enter, to approach

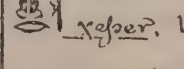
xennu, the interior, inside

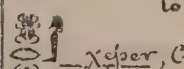

xenti, " "

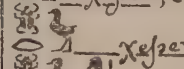

xen, a lake

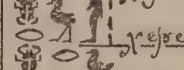

xeper, the earth, the world

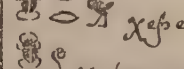

xeper, Creator, Maker, Transformer

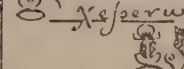

xeper, to become, to have become, to be, to form, to transform, to happen, to create, to make, to do

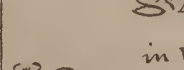

xeper, Creator, Maker, Transformer


xeperw, happened, occurred

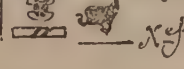

xeperuw, personally, in proper


xeperw, a scarabaeus


xeperw, occurred, happened


xeper em renpit, it was in the year

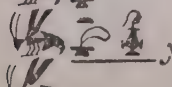
xeperer, a figure, an image

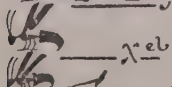

xepesh, a helmet

X

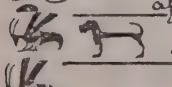
xebt, royal chancellor

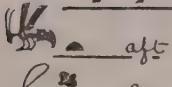
" " "

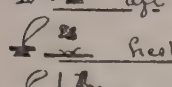

xebt, to consume, burn, combustion

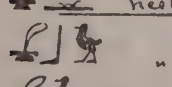

xeb, the north, Lower Egypt

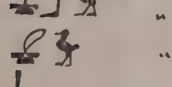
aft, a box, a cheat

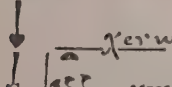

ment, a seat, a lounge

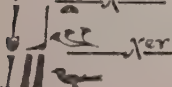

aft, work, a job

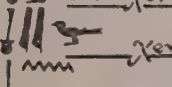

hesbu, revenue

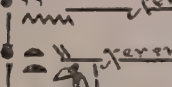

" "

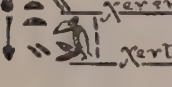

" "


xer·w, words, voice, language


xerbet, a stick, a branch


xeri, enemy, evil


xerenti, two, division


xertiw, words, matters, reports, negociations

xerw, words, voice, aloud voices

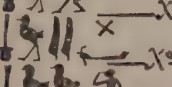
xerui, enemies, the fallen

xerui, an outlaw, robber, brigand

" " " "

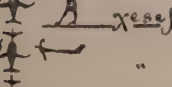
xerui, a brigand, a murderer

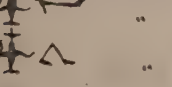
xeru, an enemy, the fallen

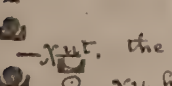

xerui, " "

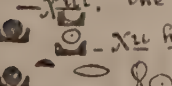
xeruu, " "

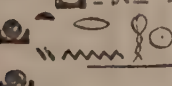
xesef, to repulse, to turn back, fight

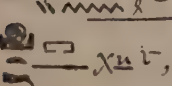

" " " " "

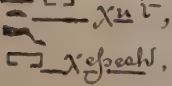

" " " " "


xut, the eastern horizon

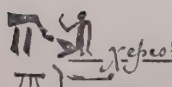

xu hah, the tomb

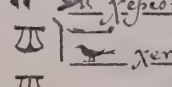

xuti er ser heb, the tomb

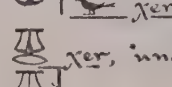

xut, the tomb

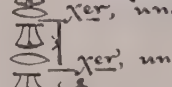

xesfeah, a forge, smelting-works, place where weapons were made

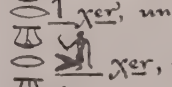
xer

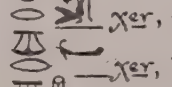

xefechi, a man of the sword, a warrior.

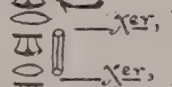

xera, that which is repugnant

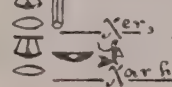

xer, under, at

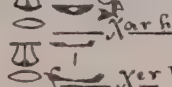

xer, under, to have, to possess

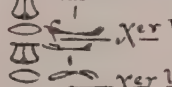

xer, an inferior, a subject

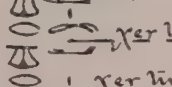

xer, to carry, to have, to possess

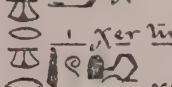

xer, food


xarheb, a priest, a choachyte priest

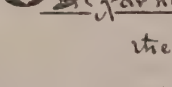

xer tut, to handle, to prepare, to work


xer tut, an instrument for writing

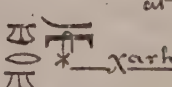

xer tut, a servant, a valet


xeraw, a fight, to fight, a battle, a quarrel, an attack, a struggle, opposition, impediment

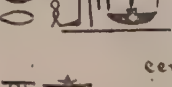
xarheb, a priest, choachyte priest, the priest who leads the ceremonies at festivals


xarh, night

xeraf, a Horoscope


xerhebs, a priest who leds the ceremonies at festivals

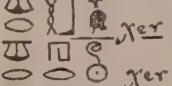
xerhetef, the just man

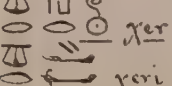

xeriuw, with them

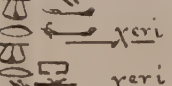
xerheb, leader of ceremonies

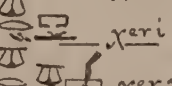
xerhrw, " "

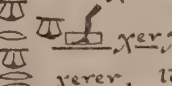
xeri tut, a servant, a valet


xeri, a hound


xerxer, to prepare

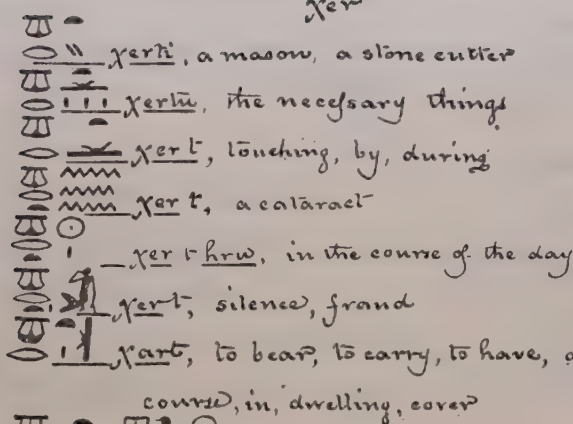

xerer, to cackle


xersti, a chandelier (censer)


xer neterti, the Necropolis, the Divine Lower Region

xert, a boy

Xer



xerti, a mason, a stone cutter

xerui, the necessary things

xert, touching, by, during

xert, a cataract

xer t hrw, in the course of the day

xert, silence, fraud

xart, to bear, to carry, to have, a course, in, dwelling, cover

xert hrw, in the course of the day

xart, source, prosperity

xartui, testicles

xeru, to take, to catch

xeruw, testicles

xemw, objects, matter

xerui, testicles

xer under, to, towards, at, to carry, to have, to

xer, support, subsistence

xert, mason, sculptor, stone cutter

xerti, " " "

xet, harem, concubine

xeruf, an ape

xerui, dwellers, inhabitants, natives

xer xeben t, the unjust, the unjust man, a rogue

xera, a fish

xer, weapons of war

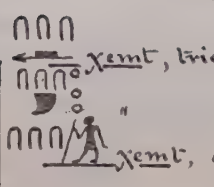
xeraw, " "

xer, " "

xeraw, a male

xeranti, "

She, shaa



xemt, trident, harpoon, boar spear

" " " "

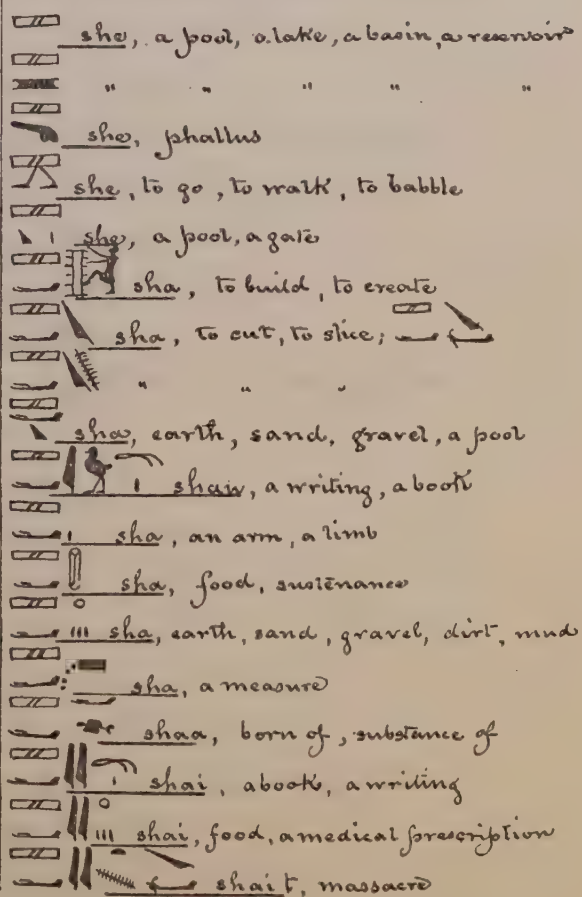
xemt, a full grown man, a man thirty years of age

xemt, " " " " "

xakn, a razor

xeker, to adorn, to cover, to envelope

Sh



shu, a pool, a lake, a basin, a reservoir

" " " " "

shu, phallus

she, to go, to walk, to babble

shu, a pool, a gate

sha, to build, to create

sha, to cut, to slice;

" " "

shaw, earth, sand, gravel, a pool

shaiu, a writing, a book

sha, an arm, a limb

sha, food, sustenance

sha, earth, sand, gravel, dirt, mud

sha, a measure

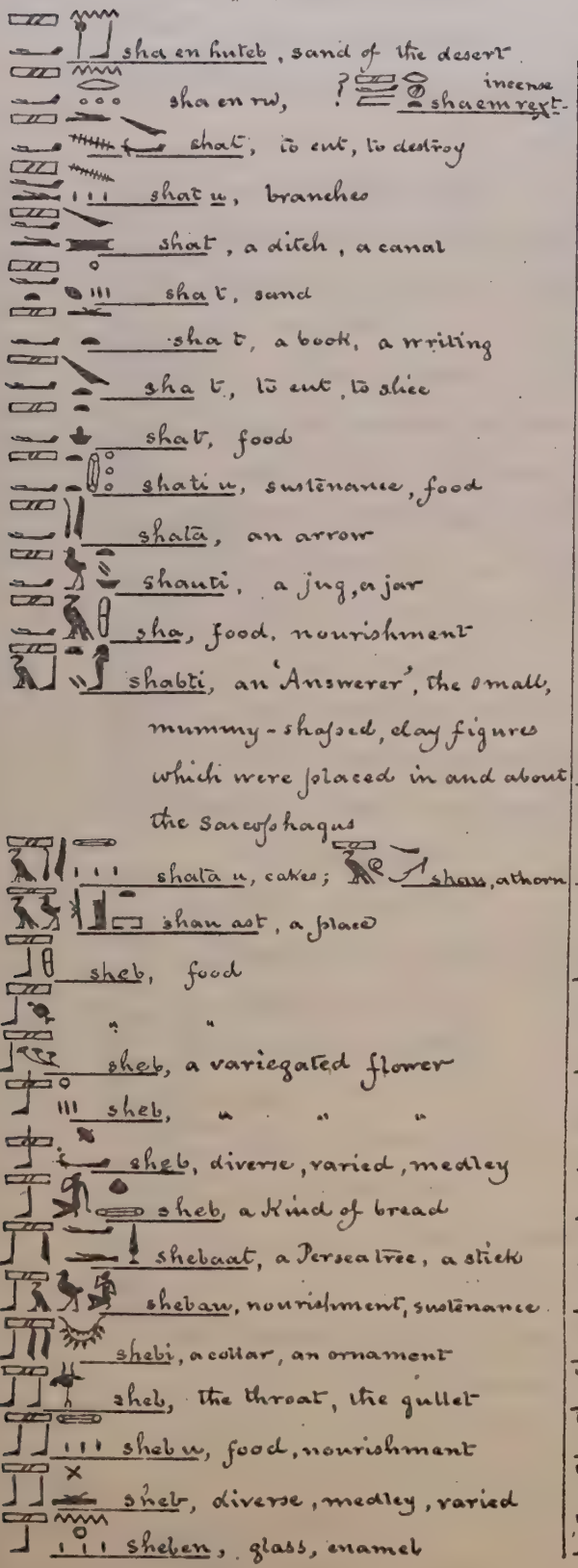
shaa, born of, substance of

shai, a book, a writing

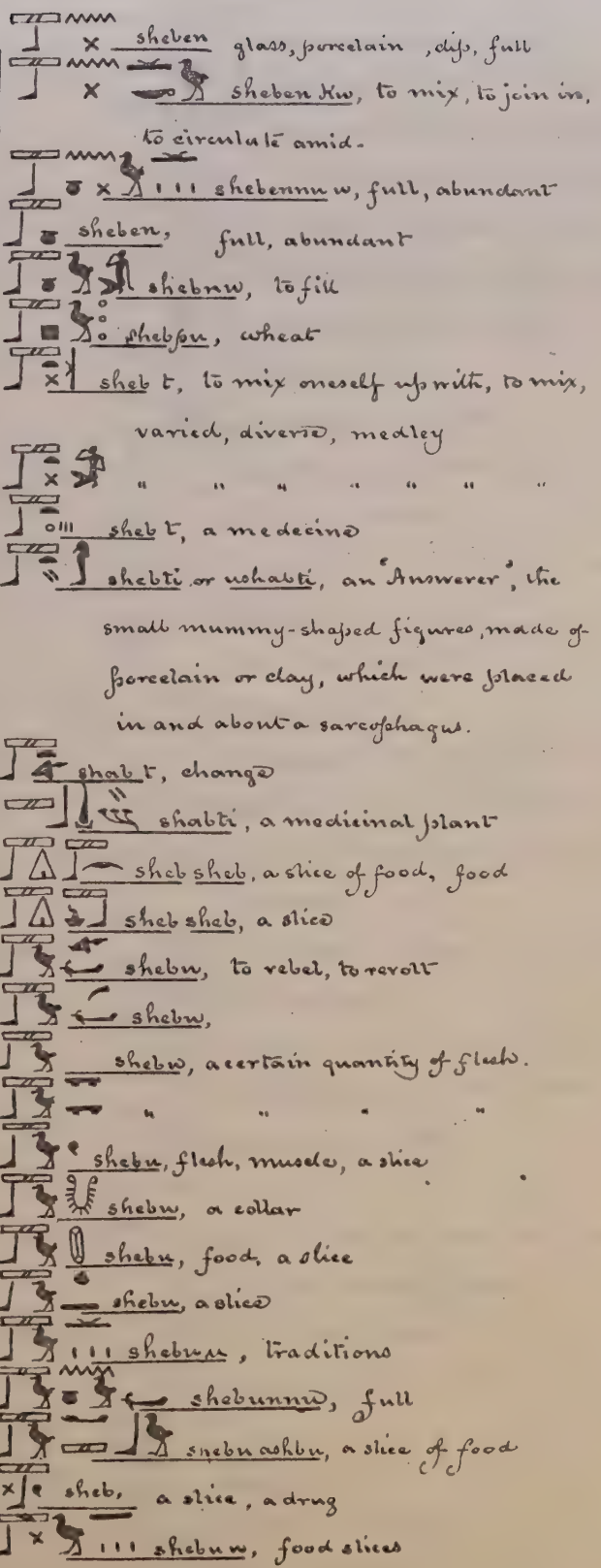
shai, food, a medical prescription

shait, massacre

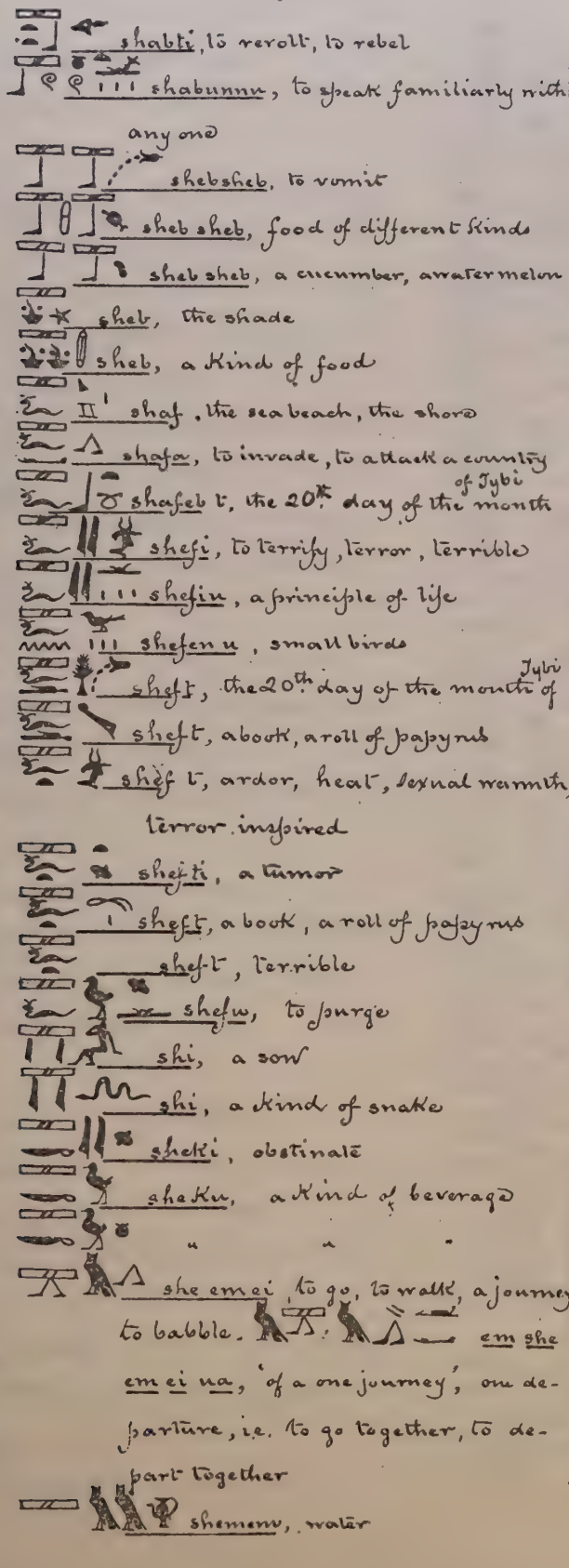
sha, sheb


sha en hureb, sand of the desert
sha en rw,
incense
shaem rext-
shat, to cut, to destroy
shat w, branches
shat, a ditch, a canal
sha t, sand
sha t, a book, a writing
sha t, to cut, to slice
shat, food
shati w, sustenance, food
shatā, an arrow
shauti, a jug, a jar
sha, food, nourishment
shabti, an 'Answerer', the small, mummy-shaped, clay figures which were placed in and about the sarcophagus
shatā w, cakes;
shaw, a thorn
shan ast, a place
sheb, food
sheb, a variegated flower
sheb, diverse, varied, medley
sheb, a kind of bread
shebaat, a Persea tree, a stick
shebaw, nourishment, sustenance
shebi, a collar, an ornament
sheb, the throat, the gullet
shebw, food, nourishment
sheb, diverse, medley, varied
sheben, glass, enamel

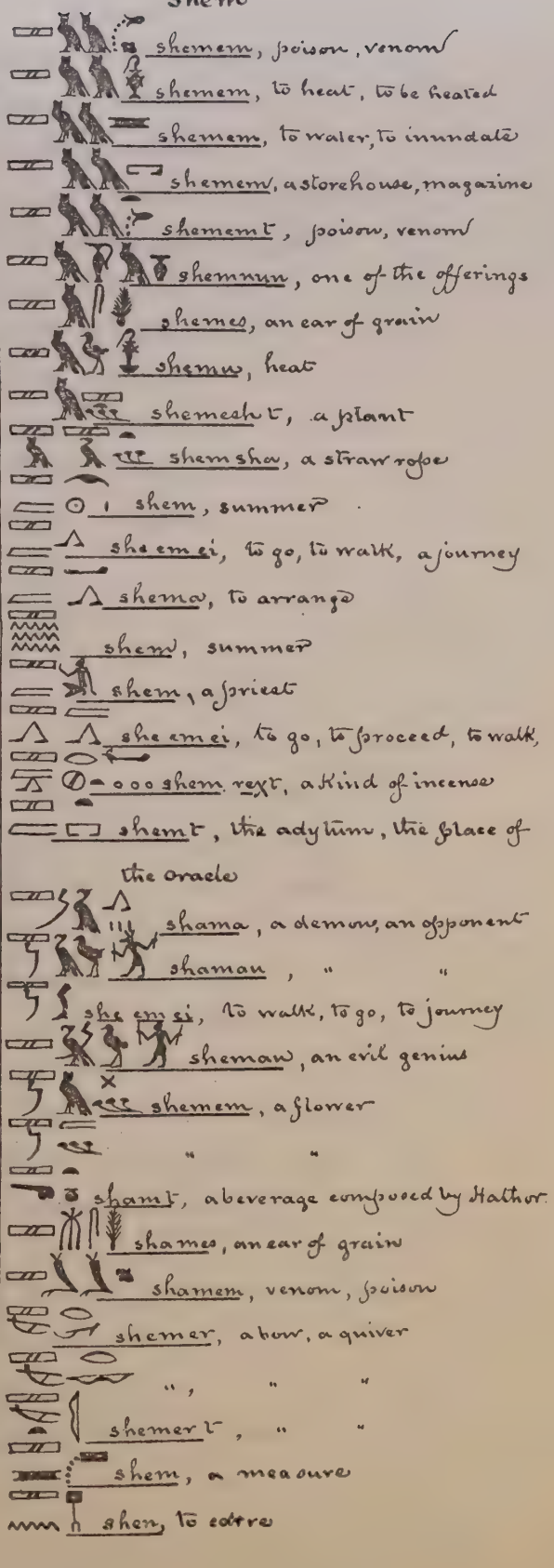
Sheb


sheben glass, porcelain, disc, full
sheben kw, to mix, to join in, to circulate amid-
shebennu w, full, abundant
sheben, full, abundant
shebnw, to fill
shebsu, wheat
sheb t, to mix oneself up with, to mix, varied, diverse, medley
sheb t, a medicine
shebti or ushabti, an 'Answerer', the small mummy-shaped figures, made of porcelain or clay, which were placed in and about a sarcophagus.
shab t, change
shabti, a medicinal plant
sheb sheb, a slice of food, food
sheb sheb, a slice
shebw, to rebel, to revolt
shebw,
shebw, a certain quantity of flesh.
shebu, flesh, muscle, a slice
shebw, a collar
shebu, food, a slice
shebu, a slice
shebuu, traditions
shebunnw, full
shebu ashbu, a slice of food
sheb, a slice, a drug
shebuw, food slices

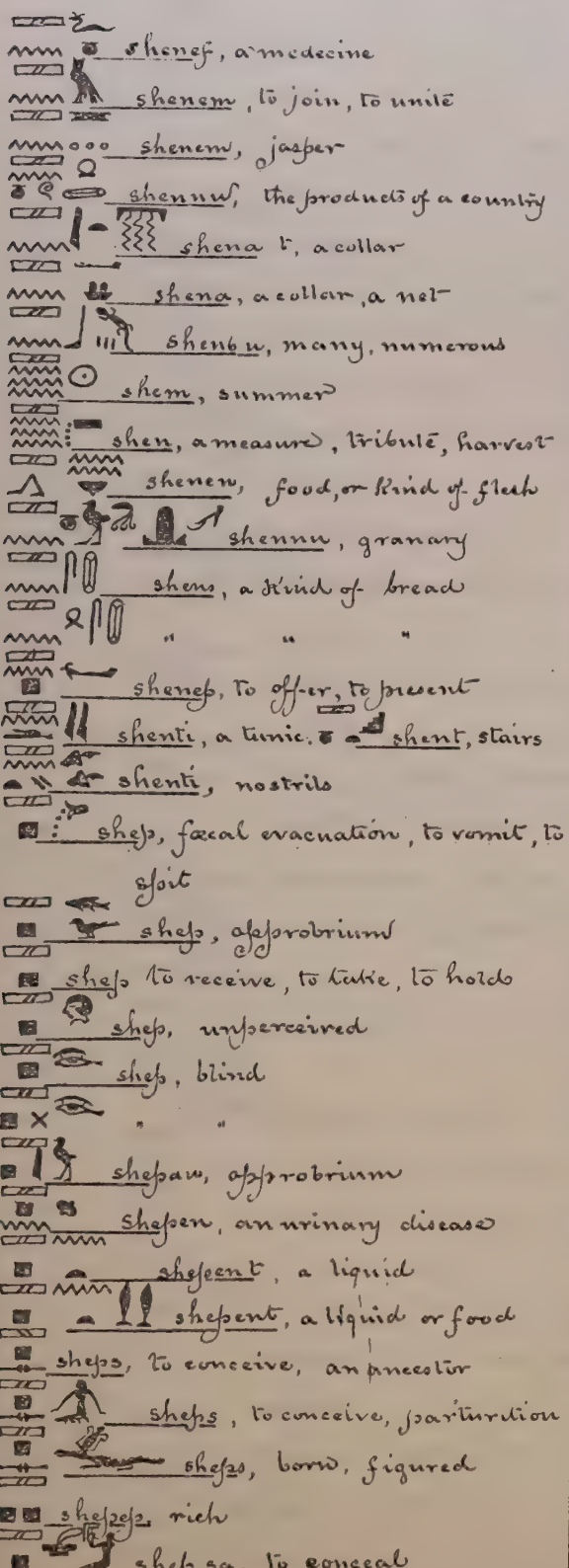
Shab, shem


shabti, to revolt, to rebel
shabunnu, to speak familiarly with any one
shebsheb, to vomit
sheb sheb, food of different kinds
sheb sheb, a cucumber, a watermelon
sheb, the shade
sheb, a kind of food
shaf, the sea beach, the shore
shafa, to invade, to attack a country
shafeb t, the 20th day of the month of Tybi
shefi, to terrify, terror, terrible
shefiu, a principle of life
shefenu, small birds
shefit, the 20th day of the month of Tybi
shefit, a book, a roll of papyrus
shef t, ardor, heat, sexual warmth, terror inspired
shefti, a tumor
shefit, a book, a roll of papyrus
shef t, terrible
shefu, to purge
shi, a son
shi, a kind of snake
shekti, obstinate
shekn, a kind of beverage
" "
shemei, to go, to walk, a journey
to babble
em she em ei na, 'of a one journey', one departure, i.e. to go together, to depart together
shemenu, water

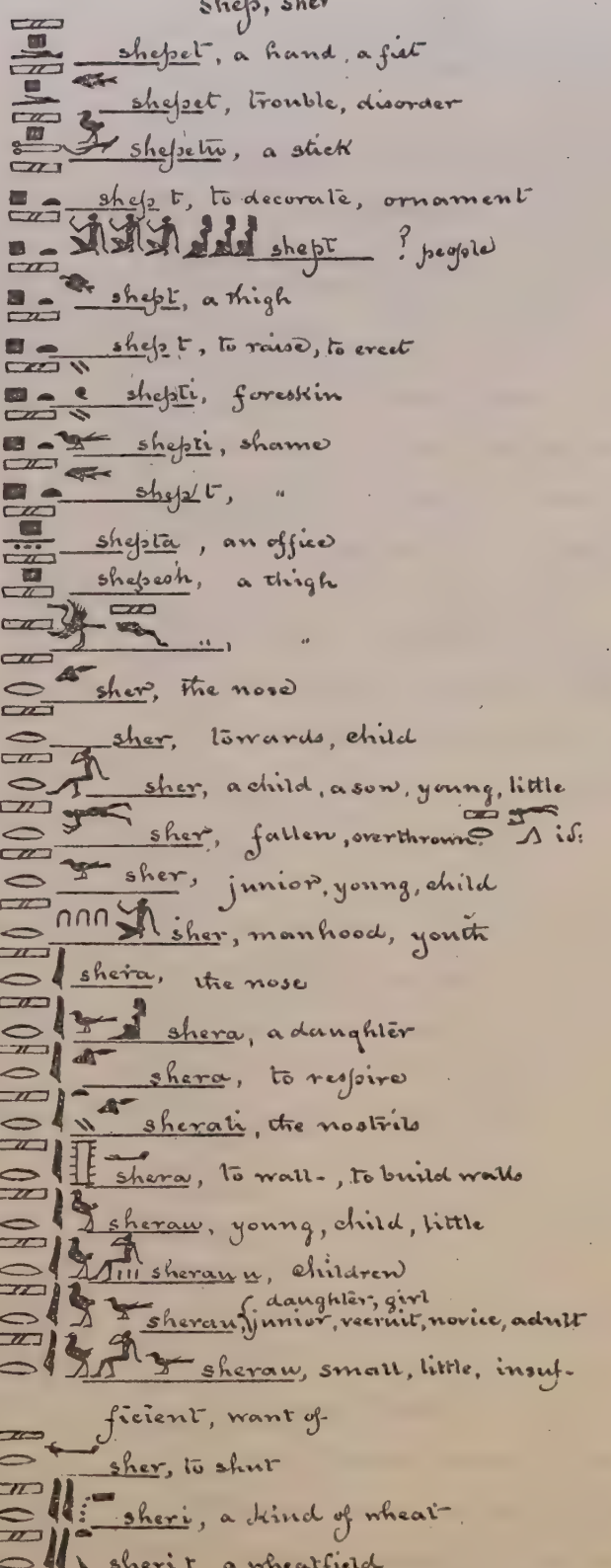
Shem


shemem, poison, venom
shemem, to heat, to be heated
shemem, to water, to inundate
shemem, a storehouse, magazine
shememt, poison, venom
shemmun, one of the offerings
shemes, an ear of grain
shemw, heat
shemeht, a plant
shemshaw, a straw rope
shem, summer
shemei, to go, to walk, a journey
shemaw, to arrange
shemw, summer
shem, a priest
shemei, to go, to proceed, to walk
shem rext, a kind of incense
shemt, the adytum, the place of the oracle
shama, a demon, an opponent
shaman, " "
shemei, to walk, to go, to journey
shemaw, an evil genius
shemem, a flower
" "
shamt, a beverage composed by Hathor
shames, an ear of grain
shamem, venom, poison
shemer, a bow, a quiver
" " "
shemert, " "
shem, a measure
shen, to extend

shen



shef, sher



sher, shes, shet

sher, a spring, a river

sher, a wheatfield

sher, a spring, a river

sher w, !

sherpw, first seed

shert, a kind of wheat, barley?

shert, a bandage, a mummy wrap

sheru, barley

sherui, the nostrils

" "

shersh, to run

sher sher, to breathe happily, joys

sherw, an inferior kind of incense

shera, a kind of wheat, first fruit of the wheat harvest

shes, experienced, skilful

shes, to serve, to follow, to minister

" " " "

shesaw, experienced, skilful

" " "

sheow, a kind of antelope

shes, a kind of antelope

shens, a kind of food, bread

shes, flax, linen

shesa, eloquent, skilful, is generally used in reference to scribes

shestet, lapis lazuli

shest, the breast

shes, to depart, to go away

shet

shes nen shei, a kind of food

" " " " "

shet, to cover, to envelope, to clothe

shet sheti, blind

shet, secret, mystic

sheta, a hound

shetba, "

sheti t, secret, sacred

shet t, a box, a sarcophagus

shetā, the grave, the sepulchre

sheta wr, great mystery, impenetrable, difficult, inconceivable

shtau, two hundred, 200

shtā, secret, mystery; shetai, id:

shtā, a box, a sarcophagus; id:

sheta, the portion of the soil covered by the Niles' inundation

shet, to cover, to envelope

sheta, secret, mystery, inconceivable

sheta, defective, wanting

shtai, secret, spacious

shtār, a betrothed wife

shtat, a chest, a box

" " "

" " "

" " "

shtā, a chest, a box, a sarcophagus

shtā tu, spaced

shtāt, a chest, a box

shtā t, secret, sacred, spacious

shtāt, secret, mystery, difficult

shtā t, the back of the head, occiput

shet, sesh

shet, closed, shut, secret, sacred,

shelēm, shut, close, finish

shet, a tortoise

shet, a basin, a lake, a reservoir

shet, a pool a lake, a reservoir

shet, a pool, a pond, a basin

ushabti, an Answerer, funereal figure

shet, mystery, space, void

shet, a chest, a sarcophagus, a box

shetit, " " " "

shet, thing, matter, affair

shet, to cover, to envelope

shet, a mortar

shet, a grave, tomb, sepulchre

shetā, secret, mysterious

shebti, to revolt, to rebel

shebti, to crush, to pound, trample

shebtū, " " "

shetu, men in charge of the sacred lakes

shua, a Persea tree

shut, shade; shet, flour

shui, "

shun, "

shtā, mystery

shesu, food

sesh, the harvest

sesh, the throat

sesha, white

sesha, to extend, to enlarge, to elongate

sha, shaw

born, to rise, to ascend the throne, to shine

sha, a crown, a diadem

sha, to rise, to be born, to come to the throne, a child; It also designated the festivals when the divine statues were paraded in the extramural processions

per sha, crown-house

sha, a healed, dry place, a desert

sha, a crown, a diadem

shaw, weapons in general

sha, an instrument, an implement, a tool, equipment

sha, rule, prevail, rise, advent

shaa, " " " "

shab, a Persea tree

shai, an instrument, an utensil, a tool, an implement, equipment

shai, an ornament, the second hall of Dendera, the hall of processions

shai, an animal

shaku, to rule, to command, to domineer

sham, to fall, to lessen, weak

shamu, to fall, to lessen, to diminish, humbled, lowered

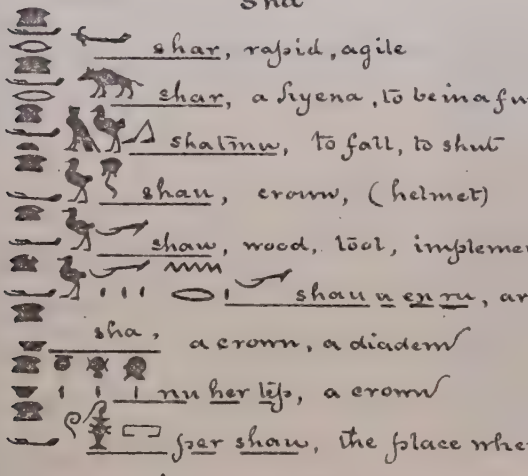
sham, " " " " " "

sha nu ru kab, armor

" " " " " "

shaw, a crown

Sha



shar, rapid, agile

shar, a hyena, to be in a fury

shalīnw, to fall, to shut

shau, crown, (helmet)

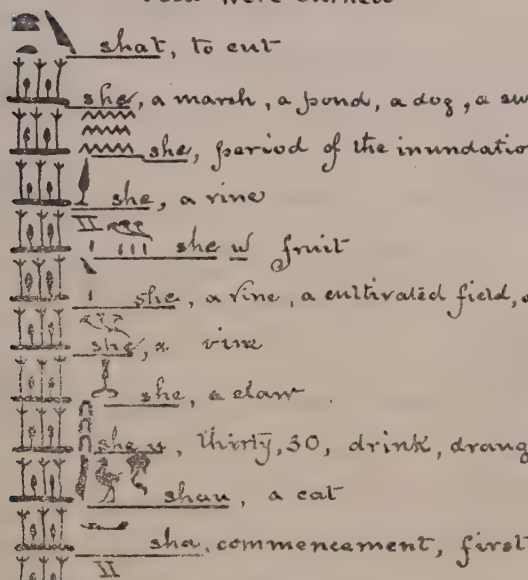
shaw, wood, tool, implement

shau n er nu, armor

sha, a crown, a diadem

nn her tes, a crown

per shau, the place where convicts were burned



shat, to cut

she, a marsh, a pond, a dog, a swamp

she, period of the inundation

she, a vine

she w fruit

she, a vine, a cultivated field, or land

she, a vine

she, a claw

she w, thirty, 30, drink, draught

shau, a cat

sha, commencement, first

shau, cause

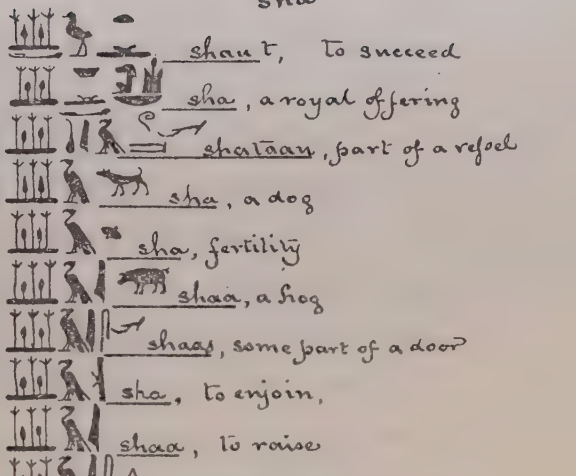
she u, papyrus pond

sha, towards, at, by, commence

shas, to run, to travel

sha, commencement, since, until

Sha



shau t, to succeed

sha, a royal offering

shatāau, part of a vessel

sha, a dog

sha, fertility

shaa, a hog

shaas, some part of a door

sha, to enjoin,

shaa, to raise

shaas, to cross, to leave behind

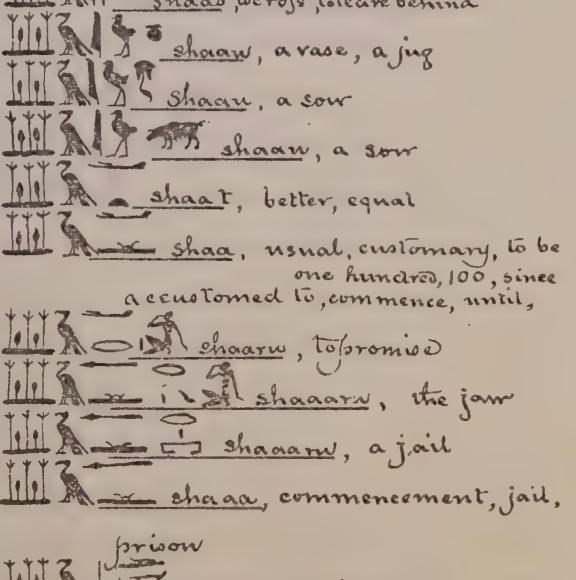
shaaw, a vase, a jug

shaau, a sow

shaaw, a sow

shaat, better, equal

shaa, usual, customary, to be one hundred, 100, since accustomed to, commence, until,



shaarw, to promise

shaaarw, the jaw

shaaarw, a jail

shaaa, commencement, jail, prison

shabēt t, a stick, a cane, a wand

shab t, an 'Answerer', the small sepulchral figures, of clay or porcelain, placed in and about the sarcophagus

shabti, " " " " " "

shabw, a bargeman, a pilot

shabut, a saw

shaf, to devastate by fire

shai, a hound

shai, commencement, 'ab ovo'

shai w, number

shakarw, shekels

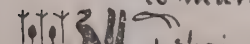
sharēt, a scorpion

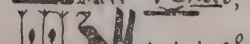
shatairw, a stick

shatau, a part of a boat

sham, shaf, shar

shai, to knock down, to beat, to murder, to kill, a loss

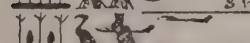

shai, superior


shai, pay, a quit-rent, first, superior, fertility

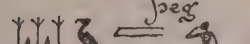
shait, riches

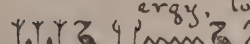
shait, to knock down, to beat, to murder, to kill, a loss

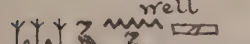
shama, a pike

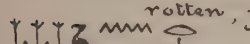

shama, to seek with energy, to abandon, to give up

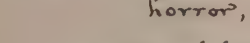
shama, a small stake, a peg

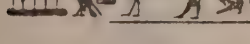

shama, to seek with energy, to abandon, to give up

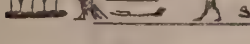

shakana, a well

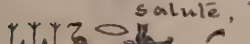

shanash, to stink, decay, rotten, foetid, impure, dirty

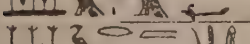

shannu, to be terrified, horror, mental terror, to make one's hair stand on end

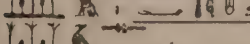

shapu, to incline, to salute


sharuma (salaam) to salute, to pay one's respects


sharuma, repose


shammalā, bread, food


shas, to cross, to leave behind

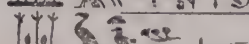

shat, to dig

shat, to catch in a net

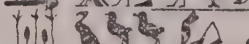
shati, foliated

shat,

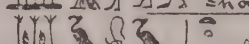
shatimā, achasm, precipice

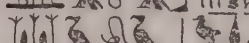

shatu, a vine

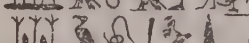
shaubu, fire, to light

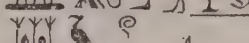

shaui, to walk, to go

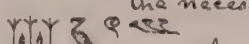
shaui, to cross


shauaabu, fruit of Persea tree


shauaabu, wood of Persea tree

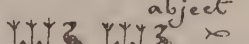

shauabu, a Persea tree


shau, of fortune, useful, facile, serviceable, good for, the essential, the necessary, it would be well-

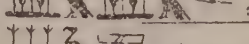

shauu, water plants

shasha, figs of Persea tree

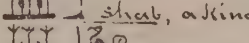
shasha, disgrace, opprobrium, ignominious, rascality, abject


shasha, bitter

shasha, myrrh

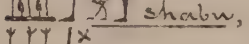

shash, to follow

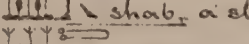
shab, a kind of vase

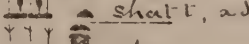

shebau, an 'Answerer', one of the clay or porcelain figures found in and around the Sarcophagus

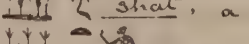
shabti, " " " "

shabu, " " " "

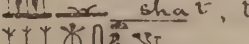

shab, a slice

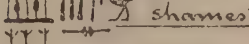

shat, a kind of bread


shat, a sow, a birch


shati, a field laborer, a peasant

shat, to enjoin


shamestu, a medicinal plant

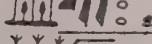

shas, to run, to travel, to follow

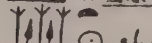
she, shu, shew

sherem, to deprive, to carry off, to drive out

shekru, rings

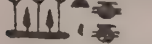
sheki u, earrings

 shem, a vase; when followed by en hut-nub, (white gold or silver) a silver weight

 shati, a field laborer, peasant

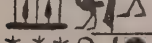
shet, the period of the inundation

shet, wind

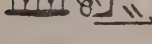
 " "

shu, to devastate

shua, to walk, to go

 shuabti. a vase

shuabti. an 'Answerer', the clay or porcelain figures placed in and about the sarcophagus.

 shash, to shed, to disappear, to dissipate

shen, a brother, a sister, two, 2, a column

shen, a brother, an ally (God)

shew, the Governor of Upper Egypt

shen, a brother

shen, honey

shena, a brother

" "

shena t, a sister

shen t, a leg. the knee

shenti, bandy-legged

shen, a brother, a sister, two, 2

shen, an orbit

shen, a brother (God)

shew

shen, a brother

shen t, a sister

shena t, "

shena t, a hole, an orifice

shena, to turn back, to turn away

shena, " "

shena, a lion, to turn back

" " " "

shenew, a plant, a sweet herb, an incense

shen, to smell, to breathe, to prostrate oneself

shenla, (smell earth, to breathe the earth), prostration, homage

shennex t, an axe, a hatchet

" " "

shenen, to angle, to fish

shennw, a vase

shennw, two, 2, the other, a second, a neighbor, a comrade, a likeness

shenla, to prostrate oneself, to do homage

shennw, grief-, pain: , infra

shennw, a tree, a flax tree, a grove

shenti w, orchards

shenw, the next

shen, the other, a second, two, 2, a comrade, a likeness, a neighbor

shen, a brother, a sister

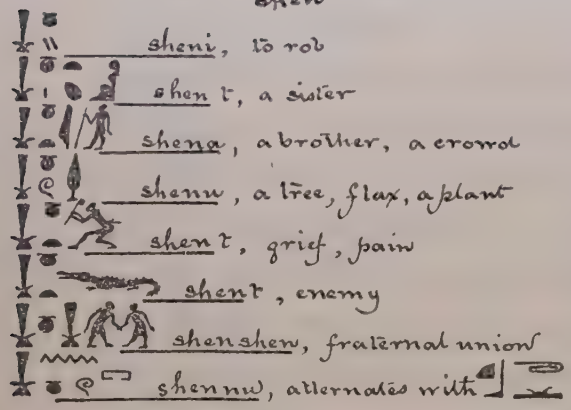
shen, a brother

sheny, brothers, (Gods)

shena, to twist, to turn away,

shena, to incline; to turn away

shew



sheni, to rob

shen t, a sister

shena, a brother, a crowd

shennu, a tree, flax, a plant

shen t, grief, pain

shent, enemy

shenshew, fraternal union

shennu, alternates with Kab to express the collective, the labyrinth, of tombs

shenshew, fraternal union, prosperity, to be double, a couple, to be two, to associate, to unite, alliance

shenshew, to breathe, respiration

shenshew, odor

" "

shenti, to baulk, to oppose, an enemy

shentetu, a relationship, an uncle, a brother-in-law

shenshew, fraternal union or seeing

shenshennu, alliance, associated

shenti, to rob, to blaspheme

shenti, frankincense

III shennu tu, color for the eyes

shenshew, fraternal union, prosperity, to be double, to be two, couple, to associate, alliance, to unite

shenti, a crowd

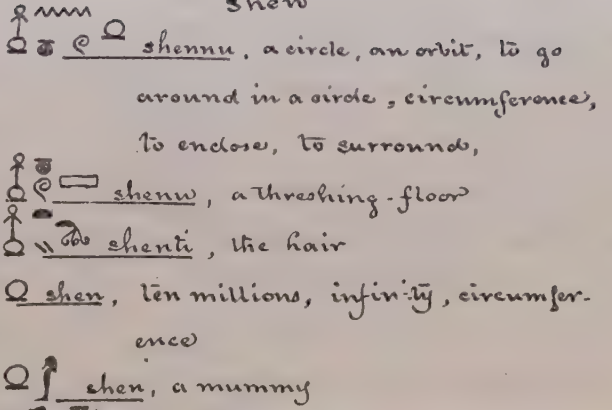
" "

shena, to defend the approaches to -

shena, a lotus

" "

shew



shennu, a circle, an orbit, to go around in a circle, circumference, to enclose, to surround,

shennu, a threshing-floor

shenti, the hair

shen, ten millions, infinity, circumference

shen, a mummy

shew, a dove cote, an aviary

shen, to turn away, to circulate, go round

shenaa, the forearm

shew, to call, to invoke, to curse

shen, the hair

shentu, a tree, or a kind of tree

" " " "

sheni, a courtier

shen, an orbit

shenat, " "

sheni, a courtier

shenw, to turn away

shenui w, acacia or oak trees

shena, a mythologic serpent

shen ur, the great sea, the Mediterranean

shen, a rule, a precept, an example

shen, each, every, to guard, to protect

shen, the hair

shati, humble, miserable

shen, the hair

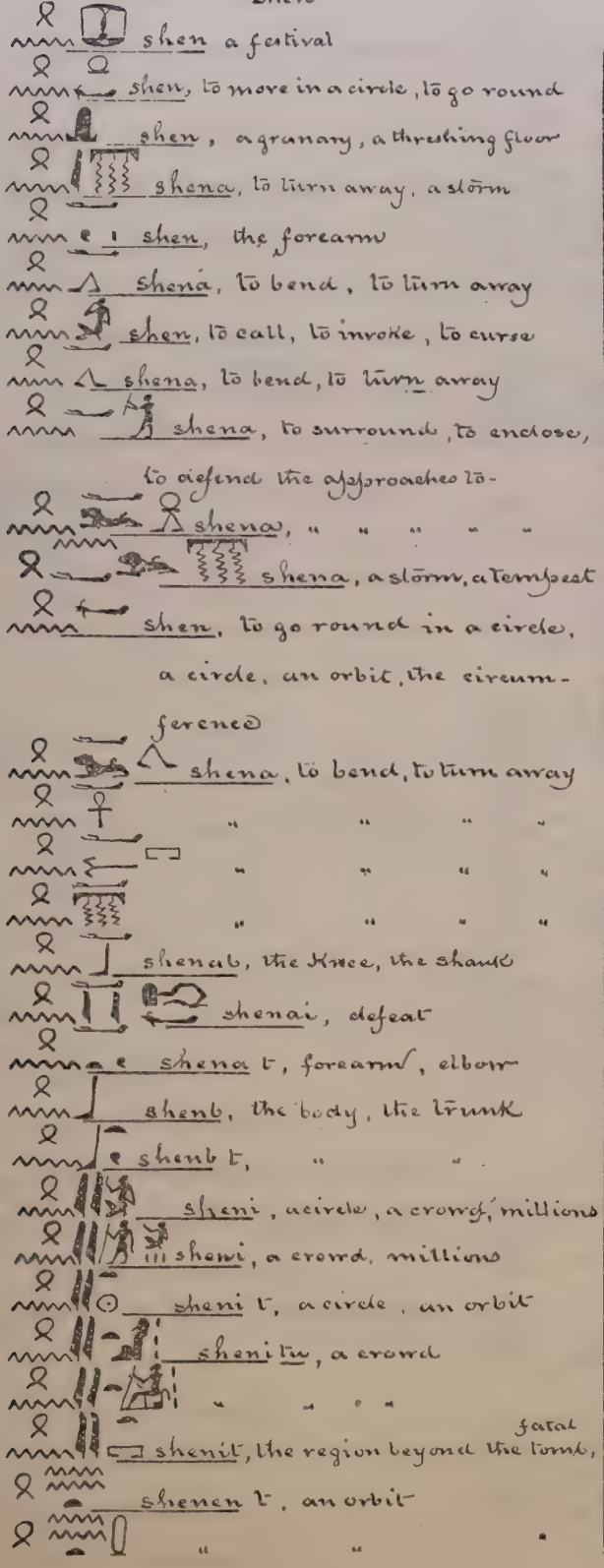
shen, circuit, enceinte, enclosure, extent

shen, to be prejudiced

shin, a circle

" "

Shen


shen a festival

shen, to move in a circle, to go round

shen, a granary, a threshing floor

shena, to turn away, a storm

shen, the forearm

shena, to bend, to turn away

shen, to call, to invoke, to curse

shena, to bend, to turn away

shena, to surround, to enclose, to defend the approaches to-

shena, " " " " "

shena, a storm, a tempest

shen, to go round in a circle, a circle, an orbit, the circumferenced

shena, to bend, to turn away

" " " "

" " " "

" " " "

shenab, the knee, the shank

shenai, defeat

shena t, forearm, elbow

shenb, the body, the trunk

shenb t, " "

sheni, a circle, a crowd, millions

sheni, a crowd, millions

sheni t, a circle, an orbit

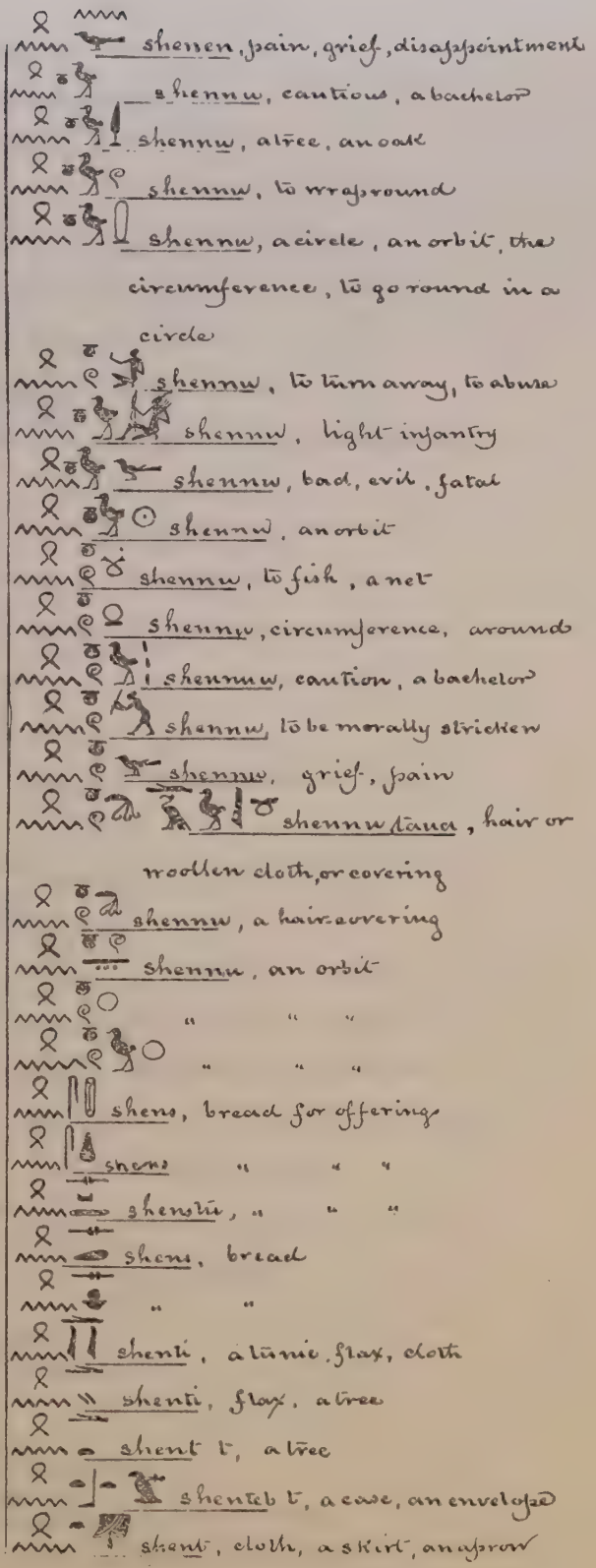
sheni tw, a crowd

" " " "

shenit, the region beyond the tomb, fatal

shenen t, an orbit

" "


shenen, pain, grief, disappointment

shennw, cautious, a bachelor

shennw, a tree, an oak

shennw, to wrap round

shennw, a circle, an orbit, the circumference, to go round in a circle

shennw, to turn away, to abuse

shennw, light infantry

shennw, bad, evil, fatal

shennw, an orbit

shennw, to fish, a net

shennw, circumference, around

shennw, caution, a bachelor

shennw, to be morally strict

shennw, grief, pain

shennw tawa, hair or woollen cloth, or covering

shennw, a hair-covering

shennw, an orbit

" " "

" " "

shens, bread for offering

shens " " "

shenstu, " " "

shens, bread

" "

shenti, a tunic, flax, cloth

shenti, flax, a tree

shent t, a tree

shenteb t, a case, an envelope

shent, cloth, a skirt, an apron

shen

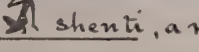
shenṛ, a papyrus roll containing laws

shenṛi, to be morally strict or

shenṛi, a granary

shenṛi, a kind of heron

shenṛi, a magical charm, an incantation, an invocation, a charm

 new shenṛi a, 'I have not used magic'

shenṛi, to call, to invoke, a curse

shenṛi, a tree, acacia-wood; the tree was held sacred in the Temple of Dendera; it furnished a medicine

shenṛeṛ, a wrapper

shenṛaṛi, a priest charged with a rite called Kemher

shen, avert

shenṛ, a granary

" "

shennuṛ, "

shenw, to grieve

shena, the forearm, the elbow

shena, to bend, to turn away

shena, forearm

shena, to bend, to turn away

" " " "

shenb, the body,

shenbṛ " "

shens, a cake

shenṯi, an enemy

shen

 shenti, a lock of hair

shenti, conjuration, control, bewitch

 shenti, a breech cloth

 shenti, to enchant, to bewitch

 shen shen, a kind of heron

 shen wr, the great sea, the Mediterranean

shenti, to turn down

 or shent, nose, in, at, reside in, dwell, stop at

 shen, to be stopped; e.g. his nose is shen, he cannot breathe

 shen, Upper Egypt in opposition to peh (behind) Lower Egypt

 shenw, a pool

 shenṛ, to dwell, to reside in

 " " " "

 shenṛ, to go up the Nile, to the S.d

 shenti, stocks

 shenti, to dwell, to reside in

 shenti, eyelid or eyelash

 shenti. Pharaoh's private cabinet, a room where he received his intimate friends

 shenti, a basin, a pond

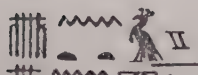
 shentilā

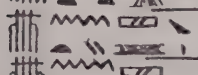
 shentii, to sail up the Nile, to go to the southward

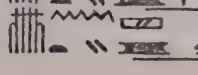
 shenti, " " " " "

 shenti, commencement, where, there, interior, power, possession

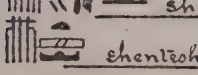
shefs, shes

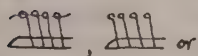

shenti, the point, the end

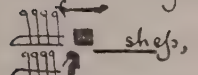

shentish, a pool

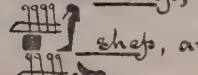

shentish, a garden, a plantation of trees, a harbor

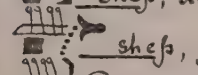
shentiu, presiding over

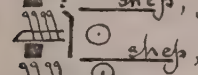

shentesh, a garden, a plantation of trees, a harbor

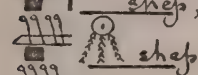

shefs, in Ptolemaic time represented number seventy, 70

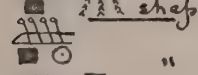

shefs, to take, to hold

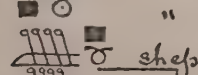

shefs, an image, a likeness, a figure

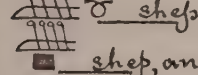

shefs, fæcal evacuation, to vomit, to spit

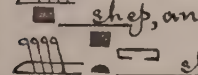

shefs, hour, time, fixed moment

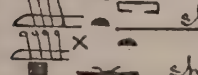

shefs, light, time, hour

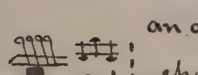

" " " "

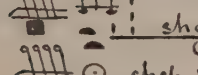

shefs, a festal garment

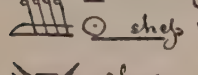

shefs, an ingredient of the Kyphi


shefs t, residence

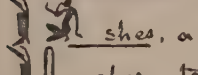

shefs t, is sometimes found as an adjective, meaning 'excellent'

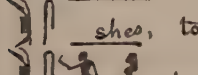

shefstu, the sphere of action


shefs t, the disk of the sun

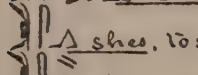

shes, to serve, to follow, id

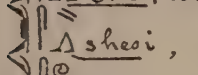
shes, a servant, a follower

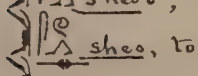

shes, to serve, to follow

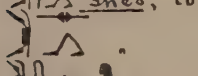

shes, servant

shes, to serve, a religious service, to follow


shesi, " " "


shes, to serve, to follow; king's servant


" " "


shes, a servant, a follower

sheswu, followed

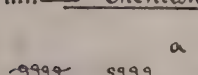
shet

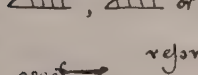
sheswu, a servant, a follower,

shet, a weight = 5 uten

shet, to execute, to act on one by word or action, to dig, to extract, to force out, to do, to accomplish

shet, to shout, to recite, to read


shet, filled; shet em arf, filled with wine


shet, to do, to accomplish, to execute, to act on anybody by word or action

shet, to roast, to stuff

shetw, pools

shet t, to nurse, to give the breast

or ushet, to acquit, to absolve, to appropriate, to adore, to render propositions, to tear, to separate, work

shet, to protect, to save

shet, a crown

shet, a crown house

i shet, a portion of land, a valley, a gorge

shetaw, spirits or lees of wine

shetaw, to employ

i shetat, a ditch

shetebt, spirits of wine

shetebt, a canal, a cistern, a well

shetebw, spirits of wine, or a kind of wine which was very alcoholic

sheti, a vase, a large jar

sheti, a ditch

sheti t, an artist

shet, shw

shet ȳeb, a kind of goose

shet en rw, " " "

shet en lēṣ, " " "

shetew, a beverage, hydromel

shet t, to work, to prepare

shet t, a pool, a ditch

shetet, to prepare

shetu, a leathern bottle, a wine skin

shetu, wine

shetet, to load an ass

shes, wheat

shetu s'mes, to fecondate

shetu, to compose, to rescue

shet, a mortar

shet / sheti — a valley, a gorge, a feature of the land

shetet, a kind of wine

shet ta, " "

shet, to fill;
em tu a shet ken-aw am a, (you me fill bosom in me), my bosom (heart) is full of (thought) of you

shetu, spirits of wine

shetu, work, prepare, to bore, drill

shw, a feather, a plume, Truth, with, at,

shw, to extend, to elongate

shw, the extent of the country

shw, the hair

shw, shade, shadow, to shine, rays

shw

shw hati, patient

shw, to shine, to dart rays

shw, the light of the sun personified

masper, a temple

maw, a sacred ornament

ma, right, proper

shubit, shade, shadow

" " "

" " "

shubw, shade, resplendence

shui, light

mat, true, real

shuti, two plumes

shuta, a palette

shw, True! Verily! Do that so?

shw, the rising sun

shw, light, rays

" " "

shw, the double plume, a solar insignia

shw, a long strip of papyrus, or of prepared cloth, for writing purpose, a book

shw, an ass, pig, swine

shw, to be in want of, to fail of, to need, employ

shw, to be deficient

shw, arid, dry land

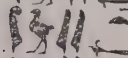
shui t, the shade

shui, flowers

shui, to be in want of, to fail of, to need, employ

shu, shen

shuit, trade, commerce


shuit, a merchant

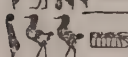
shuib, shade, shadow

shuiti, trade, commerce

shuti, a merchant

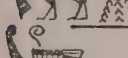
shuti, the two plumes, a solar insignia

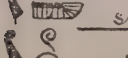
shuti, a pair of wings; id:


shui, " "

shui, material for writing on

shui, shade, shadow


shu, a ring


shu, light

shu, dry, burning, burnt

shui, " " "

shub, flesh, food

shui, dry, arid land

shui, the double plume, a temple

shuti " " "

shuw, a kind of sistrum

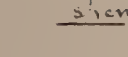
maxeru, justified

maxeru, the justified, the dead who have not been condemned in the "Hall of Two Truths"

shen, to dwell, to smell, to scent, to snuff; figuratively "to smell the earth" means to prostrate oneself

shenti, a baker

shefshu "

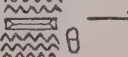

shenti "

shenti, clay, mud

sha

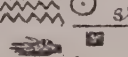
shat, a cake

sham, harvest tribute


" " "

" " "

sham summer


shefs, to take, to seize, to receive to accept

shefs, a measure, the seventh part of the large ell, the sixth of the small ell, or five fingers breadth. The hand without the thumb represents four fingers breadth, three, &c

shent, a granary.

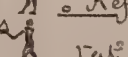
shet, to nurse, to give the breast, to read, to recite

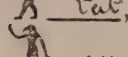
sheti a portion of land

sheti canal, well, cistern

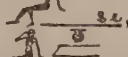
Ka, the bearer of; id, of heaven

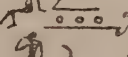
Kefni, the perfume of Kefni


kat, to give, to place

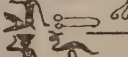

amen, a beholder

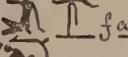
se, a son, a child, see page 162

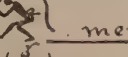

xenem, jasper


ba, the soul

fekel, a shorn man, a priest


fas, a kind of wood


mer, to die


heh, numerous, many

Reh, numerous, many

san, a pastor

see page 17

" " "

see page 62

a, d, me, mine

" , " " "

TRANSACTIONS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY.

ARTICLE I.

A DICTIONARY OF THE EGYPTIAN LANGUAGE.

BY EDWARD Y. McCAULEY, U. S. N.

Read October 20, 1882.

PREFACE.

In 1880, I made a manuscript copy of Dr. Birch's Egyptian Dictionary (Vol. V, of Bunsen's Egypt). As it was inadequate for the present requirement I added to it a list of words compiled from translations, lately made, of papyrus texts and monumental inscriptions, with the aid of Chabas' Melanges Egyptologiques, and the works of Grebaut, Deveria, Goodwin, &c. Finally, I closely compared the work with Pierret's Vocabulaire, the latest issue of the kind, resulting in the Dictionary now laid before the Society.

I claim for it that it contains all the words that could be obtained from the sources I have just mentioned, and probably all that have been defined by Egyptologists up to the present time.

These words, and their variants, are placed under their proper initial symbols or characters, which, being carefully indexed, even the uninitiated may work out the meaning of a hieroglyphical text.

I have not placed any geographical or theological names in the book. Our constantly increasing information on the geography and religion of ancient Egypt, necessitating constant correction, I thought it better to restrict myself to the compilation of a book that would be of use in translating ordinary lingual text.

E. Y. McCAULEY.

PHILADELPHIA, December, 1882.

ARTICLE II.

ON THE INTERCENTRUM OF THE TERRESTRIAL VERTEBRATA.

BY E. D. COPE.

Read before the American Philosophical Society, January 1, 1886.

Since the discovery of the rhachitomous Batrachia, two different views of the homologies of the segments which compose the bodies of their vertebræ have been maintained. According to the one first proposed, that of the writer,* the segments in the accompanying cuts of *Trimerorhachis insignis* Cope, and *Eryops megacephalus* Cope, marked *p*, represent the centrum proper; while those marked *i*, are pieces which are

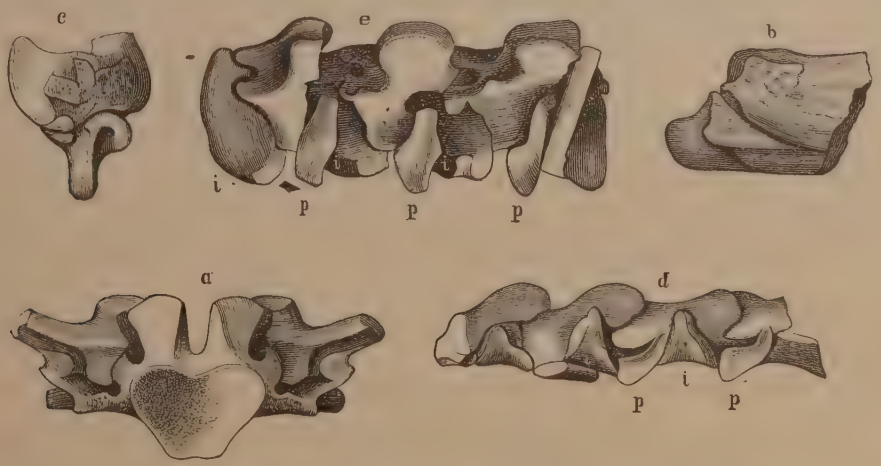


FIG. 1.—*Trimerorhachis insignis; a*, occiput from behind; *b*, angle of the mandible, side; *c*, do. from behind; *d*, part of vertebral column, lateral view, neural arches resting on intercentra through a loss of chorda dorsalis and pressure; *e*, do. obliquely from above; *i*, intercentra; *p*, pleurocentra. Original; from American Naturalist, 1884, p. 33. From the Permian of Texas. Natural size.

intercalated between the true vertebræ, and are, therefore, appropriately termed *intercentra*. According to the second interpretation, that of Professor Gaudry,† the three elements *p p* and *i*, together, constitute a vertebra. It follows that *i* cannot then be

*American Naturalist, 1878, p. 327. Proceedings Amer. Philosoph. Society, 1878, p. 510, 518, 522. Naturalist, 1878, p. 633; 1886, 75.

†Bulletin de la Société Geologique, France, 1878, p. 62; Enchainements du Monde Animal, 1883, p. 271.

properly termed an intercentrum, so it is named by Gaudry the hypocentrum. The question as to which of these interpretations is correct has an important bearing on the homologies of the corresponding parts in other batrachians and in reptiles; and

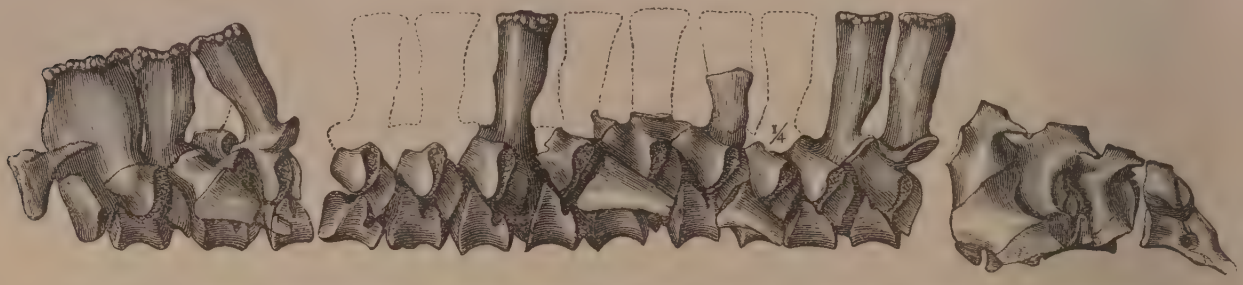


FIG. 2.—*Eryops megacephalus;* vertebral column from the left side, one-fourth natural size. Original; from Proceedings American Philosoph. Society, 1881.

the phylogenies of these classes cannot be determined until the question is settled. The following pages are devoted to this subject.

I.—THE BATRACHIAN INTERCENTRUM.

That the intercentrum exists is shown by the very frequent occurrence in the Pelycosaurian reptiles of the Permian epoch, of a wedge-shaped bone between the vertebral centra on their inferior side* (Plate I, Fig. 9). Apparently homologous elements occur in the dorsal and cervical regions of Sphenodon,† and in the cervical regions of various other lizards. Similar pieces are found in the dorsal and caudal regions of various Mammalia, for instance, Erinaceus.‡ But in general they are wanting from Mammalia, and are better developed in the Pelycosauria than in any other order of reptiles.

In the Pelycosauria (Clepsydrops, Dimetrodon), the intercentra of the caudal region are continuous with, or form a wedge-shaped common head, of the chevron bones (Plate I, Fig. 9). In the rhachitomous Eryops, in the caudal part of the column, the pieces which correspond with the intercentra of the Pelycosauria in forming the expanded heads of the chevron bones, are those which I have termed intercentra, and which Professor Gaudry has called hypocentra (Plate I, Fig. 1). Here, as in the dorsal region (Cut 2), the intercentra present their lateral angles upwards towards the neural arch. The neural arch rests exclusively on the pleurocentrum, which in turn adheres to the intercentrum behind it by its long side, and to that in front of it by its short side or end. The diapophysis belongs exclusively to the basal part of the neural arch in the dorsal and cervical regions, and its extremity forms a vertical

* Cope, Proceeds. Amer. Philos. Soc., 1878, p. 510; 1880, p. 38.

† Günther, Transac. Royal Society, 1867, Pl. ii, Fig. 17; Albrecht,

‡ Meyer, Neues Jahrbuch f. Mineral., Bd. II, pp. 229–30.

articulation for a single-headed rib. In the cervical region the articular surface for the rib is continued downwards, forming a shallow groove on the posterior part of the side of the intercentrum. This groove becomes shorter, and finally disappears from the intercentra at some distance posterior to the cervical region. In the cervical region in some of the specimens a groove crosses the inferior side of the intercentrum, passing through and dividing into two parts the costal groove. It appears to be a suture which cuts off a segment from the posterior side of the intercentrum. This segment is coössified with the intercentrum in most of the cervical vertebræ of *Eryops megacephalus*, and disappears so completely from the vertebræ posterior to this region, that it is impossible to say whether it is primitively absent, or coössified. The narrower anteroposterior diameter of the intercentra, and the absence of the lateral costal articular groove would indicate its total absence. This element has been observed by Fritsch in some Bohemian forms, and has been termed by him the hypocentrum pleurale.

In the genera described by Dr. Fritsch from the Permian Gaskohle of Bohemia some conditions have been described by him which differ considerably from those mentioned above. The figures given by Dr. Fritsch are not entirely consistent with each other, and appear to have been taken from imperfect specimens. Thus in *Sparagmites lacertinus* Fr.,* a neural arch is represented as resting on an intercentrum, while the arch next behind it rests on a hypocentrum pleurale, or a divided pleurocentrum. It is not possible to be certain whether the neural arch stands on the centrum or intercentrum in the caudal region of Diplovertebron, as in some figures it covers both (Pl. 52, Fig. 2), and in others only one of these elements (Pl. 50, Fig. 14). In the caudal region of the *Diplovertebron punctatum*,† the vertebræ have different forms, one being produced inferiorly apparently for a chevron bone, and another posterior to it, being without prolongation, and without chevron. It is not possible to be sure from Dr. Fritsch's descriptions and figures whether the chevron bones are articulated, or are continua, in these genera.

Dr. Fritsch, however, determines the presence for the first time of the hypocentrum pleurale, and describes it in the genera Chelydosaurus and Sphenosaurus.‡ With Gaudry, however, he regards the intercentrum as the true centrum, and then homologizes the hypocentrum pleurale with the intercentrum of the Pelycosauria.

I have attempted to sustain my interpretation of these homologies§ by reference

* Fauna der Gaskohle der Permiformations Bœhmens, Bd. ii, H. 1, Pl. 50, Fig. 16.

† Loc. cit., Pl. 50, Fig. 14. Dr. Fritsch believes the inferior long bone to be a rib.

‡ Loc. cit., pp. 25–28.

§ American Naturalist, 1885, p. 76; Proceeds. Amer. Philos. Soc., 1878, p. 522.

to the genus Cricotus, type of the order Embolomeri; a form which has not yet been found in Europe, so far as ascertainable. In this genus the chevron bones are continua, while the neural arch is free, as in Eryops. The element which bears the chevron bone being regarded, as in that genus, as the intercentrum, we can affirm (Fig. 3) that the intercentrum is continued upwards to the neural canal, forming a disk, and the pleurocentra are continued downwards and are united below, forming a complete centrum. This explanation looks the more reasonable in view of the existence of the hypocentrum pleurale in the Sphenosauridæ, which if combined with the pleurocentra would form a completed centrum. It is, however, uncertain as yet whether this is the make-up of the centrum in Cricotus, because in Eryops the hypocentrum pleurale unites with the intercentrum and not with the pleurocentrum. That my determination of the homologies of the vertebral disks in Cricotus is correct is further evidenced by the structure of the caudal region of Eryops. In *E. erytholiticus* (Pl. I, Fig. 1), the pleurocentra descend further than in the dorsal region, reaching to the inferior face of the column, and separating the intercentra from mutual contact.

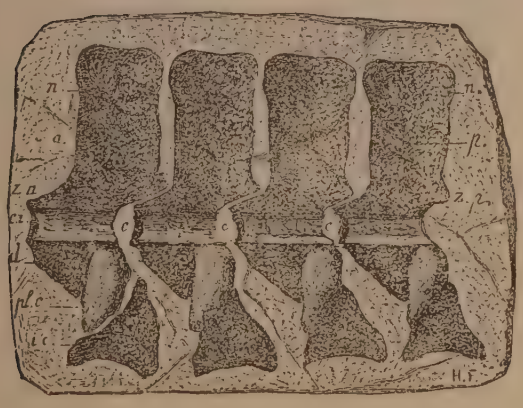
FIG. 3.—*Cricotus crassidiscus* Cope, posterior part of vertebral column two-fifths natural size; original; from American Naturalist, 1884, p. 37. Fig. *a*, proatlas; *b*, do., with first cervical; *c*, cervicals; *d*, proximal caudals from below; *e*, distal caudals left side. *Pu*, pubis; *il*, ilium; *is*, ischium; *i*, intercentrum; *ce*, centrum (pleurocentrum); *r*, ribs.

Further development of their inferior portion, with truncation of inferior surface, would represent the structure stated by Fritsch to characterize Archegosaurus, and which is still better developed in Cricotus. The chevron bones are always continua in both Eryops and Cricotus. Of the latter genus I possess in my collection many caudal intercentra with chevrons, of all ages, and in none of them is there any sutural articulation visible (Pl. I, Fig. 6).

The correctness of this determination is further confirmed by a study of the dorsal region of Cricotus. In passing along the caudal region towards the sacrum, the chevron-bearing disks or intercentra diminish in anteroposterior diameter both absolutely and relatively, while the centra do not undergo any modification. The neural

arch, from resting by more than half its base on the intercentrum (Fig. 3) gradually transfers itself to the centrum, at the base of the caudal series. It maintains this position throughout the lumbar and dorsal series,* resting freely in an angular fossa of each side of the anterior three-fourths of the superior face of the centrum. It bears the diapophysis with the usual articulation for a single-headed rib (Plate I, Fig. 3). The intercentra even continue to the cervical region, which terminates anteriorly in an intercentrum, which is perhaps the body of the proatlas, the processus dentatus of the atlas of the existing Batrachia, and the occipital condyle (without basioccipital bone) of the Reptilia.† In addition to the preceding reasons for adopting my determination of centrum and intercentrum, it may be added, that in the *Cricotus heteroclitus* Cope the dorsal intercentra are much narrowed above,‡ some of them so much so as to have a sharp edge, which forms but a narrow bridge above the foramen (Plate I, Figs. 7–8) chordæ dorsalis.

According to Gaudry, the structure of the dorsal part of the vertebral column in Actinodon and Archegosaurus is identical with that of Eryops§ (Fig. 4). This



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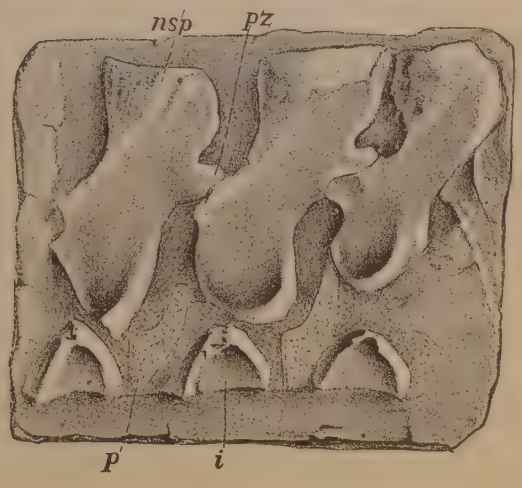


5.

FIG. 4.—*Archegosaurus decheni* Goldf. Section of dorsal vertebræ, restored by Gaudry; natural size. Let. *a*, *d*, neural arch; *c*, neural canal.

FIG. 5.—The same species; dorsal vertebræ, copied from Fritsch; natural size. Letter *i*, intercentrum; *p*, centrum; *pz*, postzygapophysis; *n. sp.*, neural spine.

author represents the neural arch as resting on the pleurocentrum. Fritsch, on the other hand,‖ represents the neural arches as slightly in contact with the intercentra, and

* Proceedings Amer. Philosoph. Soc., 1884, p. 29.

† Amer. Naturalist, 1884, p. 37.

‡ Proceeds. Amer. Philos. Society, 1877, p. 186 (see *C. discophorus*, which was founded on such intercentra)

§ Enchainements du Monde Animal, Fossiles Primaires, p. 261, fig. 259.

‖ Fauna der Goskohle, Tab. 58, fr. 13.

the pleurocentra as between their bases, a condition of things which is probably due to disturbance of the parts before fossilization (Fig. 5). Fritsch also represents the neural arch in Sphenosaurus and Chelydosaurus as resting on the intercentrum, in diagrammatic manner,* and the pleurocentra and hypocentrum pleurale as alternating with them. As Dr. Fritsch does not give profile figures of the original specimens, one cannot judge how much may be due here also to disturbance of the parts. Still more open to this question are the figures of Von Meyer.† The true relation of the parts cannot be learned from these figures and descriptions, and it is probable that the specimens at the disposal of European paleontologists generally are as yet much inferior in the condition of their perservation and in size to those found in Texas.

The vertebræ of the true Stegocephali are, so far as known, undivided and without intercentra, with one exception, and that is the genus Branchiosaurus Fritsch.‡ According to this author, each vertebral body is composed of three parts, a median, an anterior, and a posterior. The median, if separated from the other two parts, would be bi-concave, and it supports the rib. Each of the extremital segments presents a convexity towards the median segment, resembling the epiphysis of a mammal. What the homologues of the three parts may be remains to be ascertained.

II.—THE REPTILIAN INTERCENTRUM.

The Rhynchocephalian genus Sphenodon has been represented by Günther to have cervical and some dorsal intercentra.§ It therefore seemed probable that its structure might throw some light on the homologies of the batrachian and reptilian intercentra. I therefore dissected the vertebral column of a specimen in alcohol kindly presented to me by my friend, Dr. James Hector, chief of the Geological Survey of New Zealand. The attachment of the chevron bones does not, in the figure of Günther, resemble very closely that seen in Clepsydrops, but on examination I found the relations to be structurally and homologically identical with that found in Cricotus. The caudal vertebræ are separated by a rather thick disk of intervertebral cartilage which surrounds the foramen chordæ dorsalis, resembling closely the intercentrum of the Embolomeri. There is an internal annular deposit of phosphate of lime, which, if extended to the entire cartilage, would give us an embolomerous intercentrum like that of Cricotus. This resemblance is a true homology, for the chevron bones spring from this cartilage, although in slight contact with the centrum in front of it (Plate I, Fig. 10).

* Fauna der Goskohle, pp. 25–28.

† Palæontographica, 1858, Vol. vi.

‡ Fauna der Gaskohle, Bd. i, Heft. 1.

§ Transactions of the Royal Society London, 1867, pl. ii, fig. 23.

There can then be no doubt of the homology of the cartilaginous intercentrum of Sphenodon with those of the Pelycosauria, and of the entire centrum of Sphenodon with that of the Pelycosauria. The division of many of the caudal centra of Sphenodon and of many lizards, is evidently not explained by the supposition that one of the parts is an intercentrum. That they are halves of a single centrum is not only rendered probable by the above determination of the intercentrum, but is supported by the modifications presented by the centra themselves. In Sphenodon, instead of gradually losing one of the halves, the latter become, without diminution, more and more consolidated towards the anterior part of the caudal series, and merge into the ordinary type of vertebra, each proximal centrum representing both halves of a distal one (Plate I, Fig. 10).

It is thus probable that each vertebra of a Lacertilian* and of a Pelycosaurian represents one centrum, and that intercentra are present in some types, and absent in others, except as always represented by the chevron bones of the tail. Is this the case with the existing Batrachia?

FIG. 6.—*Eryops megacephalus*. Vertebral column represented in Fig. 1, from below; one-fourth natural size. From Permian epoch of Texas.

In an important memoir, Hoffman† presents us with the results of his investigations into the homologies of the ribs of the terrestrial Vertebrata. He finds that in all of them, excepting the Batrachia, the primitive ribs are processes of the intervertebral, and not of the vertebral cartilage. The intervertebral cartilage in reptiles with ball and socket joints divides, each half uniting with its adjacent body, the one to form the ball, and the other the concave extremity of a vertebra. In the Mammalia the halves form the epiphyses respectively. In this class the head of the rib justifies this origin, remaining as it does articulated in a fossa which is equally excavated from two adjacent epiphyses. I have shown that the head of the rib in the Pelycosauria is articulated with the undivided intercentrum.‡ The structure in this order is in confirmation of the doctrine that the element I have called intercentrum is such in fact. The passage of time has seen in the Reptilia in general, the same modification in the mode of attachment of ribs as occurs in the vertebral column of the Mammalia, etc., in pass-

* Baur shows that in the Lacertilian genera Uroplates and Gecko, intercentra are present throughout the dorsal, lumbar, and sacral regions. American Naturalist, 1886, p. 174.

† Niederlændisches Archiv. f. Zoölogie, 1878, p. 199.

‡ Proceeds. Amer. Philos. Society, 1884, p. 43; Proceeds. Amer. Assoc. Adv. Science, 1884, p. 474.

ing from the front to the back. The intercentral articulation is lost, and finally the head of the rib disappears. Only the tubercular attachment to the diapophysis remains, in the Streptostylica, and this is a simple one.

In the modern Batrachia the rib articulation is that of a double-headed rib to a double-headed diapophysis which originates from the neural arch. There is nothing in the history of the class to show that, as in the case of the reptiles, the head has been transferred or lost. In recent Batrachia, elements resembling the intercentra of Pelycosauria are unknown. The origin of the ribs of fishes and Batrachia have been shown by Gœtte to be in the connective tissue of the interspaces of the myocommata, which are opposite the middles of the vertebral centra. It follows that there is at no time connection of the ribs with the lines of separation of the vertebral bodies.

If the intercentra become the functional centra in the Sphenosauridæ, it is likely that they are such in the Stegocephali, and in the modern Batrachia.* It follows, then, that Batrachia, excepting Rhachitomi and Embolomeri, have no centra, but intercentra only. This view is confirmed by three facts, two of them already mentioned:

I. There are no intercentrum-like bodies in existing Batrachia.

II. The ribs which originate from intercentral cartilage and intercentra in reptiles, originate from the principal vertebral bodies in Batrachia.

III. The chevron bones are continua with intercentra in Reptilia, and with the caudal vertebral bodies of Batrachia.

With regard to the last proposition I may add, that I have examined young *Necturus maculatus*, of four inches in length; of larvæ of *Gyrinophilus porphyriticus*, of three inches; of *Spelerpes ruber* of two and a half inches; of *Amblystoma punctatum*, of 35mm; and of *Spelerpes bilineatus*, of 25mm† length. In none of these is the least trace of articulation of either chevron bone or of neural arch in any part of the column to be discovered (Plate I, Fig. 11).

Researches into the embryology of the Urodela and Anura have not yet brought to light any traces of the rhachitomous structure; which is probably a case of inexact parallelism, cœnogeny or falsification of the embryonic record—a phenomenon which is not uncommon. There can be no doubt, however, that the entire record was presented in the embryonic history of Permian land Vertebrata, and for a long period subsequently, but that the rhachitomous stage has been, *with the true centrum*, lost from the batrachian line at least.

As I have shown, in the Embolomeri the intercentra tend towards reduction in the dorsal region, while the centra are predominant. If the tendency of the evolution

* American Naturalist, 1886, p. 77.

† For these specimens I am greatly indebted to the Smithsonian Institution and the Secretary, Prof. Baird.

of the Batrachia has been to the extinction of the centrum, the line of the Embolomeri tends in the opposite direction, or towards the type of the Reptilia. Although the general characters of the skull of Cricotus are Batrachian, the presence of a free proatlas (Fig. 3, *a b*) adds to the evidence of reptilian affinity.* It is probable then that we have in the Embolomeri that order of Batrachia from which the Reptilia were derived, through intermediate forms not yet discovered.† It is also evident that the Sphenosauridæ cannot be referred to this order as I have proposed, but that they constitute a family of Rhachitomi.

We have thus clearly shadowed forth in the Permian Vertebrata the ancestry of the existing true Fishes,‡ Batrachia, Reptilia, and Mammalia.§

III.—ALTERNATIVE EXPLANATIONS.

I may here consider other possible ways of interpreting the homologies of the segments of the rhachitomous vertebral column, as follows: Let us first suppose with Gaudry and Fritsch that the segments called intercentra in the figures and plates accompanying this paper, are the true centra, and that the chevron bones are not continua, but are originally separate, and have become coössified with the elements with which we find them now continuous. It will follow that the larger bodies of the vertebral column of Cricotus, which in the dorsal region support the neural arch, are intercentra, and that the centra are in that genus in process of extinction. The same will be true of the so-called dorsal, and part or all of the so-called caudal vertebræ of Sphenodon, and of the Pelycosauria. We thus have the Reptilia in the position which I have assigned to the Batrachia, the terms centrum and intercentrum being merely reversed. As, however, these names were first applied to the Pelycosaurian reptiles by me, and as it will require less change of nomenclature to retain these names for the bodies as they appear in Mammalia and Reptilia, it will be better to maintain the proposition that the Batrachia have lost their centra, and retain only intercentra.

Another alternative is to regard the hypocentrum pleurale as the intercentrum with the chevron bone. It will be remembered that the hypocentrum pleurale is described by Dr. Fritsch as lying below the pleurocentra. This is of course on the anterior side of the "hypocentrum." It looks reasonable to suppose that in the completion of the body of which the pleurocentrum is a part, the hypocentrum pleurale should be included. Such might be supposed to be the case in the centrum of Cricotus, and of the Pely-

* The proatlantal centrum is thoroughly coössified in all the salamander larvæ above referred to.

† I have suggested this view in the American Naturalist, 1884, p. 37; 1885, p. 77.

‡ Additional specimens of Didymodus display very distinctly the sutures I have described, which Mr. Garman thinks to be accidental.

§ A second posterior foot of Clepsydrops displays perfectly the mammalian characters I have ascribed to it.

cosauria. But on this point we have as yet no evidence. On the other hand in the rhachitomous Eryops, where the centrum is not completed, we have seen that in the cervical region the hypocentrum pleurale probably unites with the intercentrum in front of it. Let us suppose this to have been the case throughout the vertebral column. The interpretations would be as follows:

In the caudal region of Eryops the hypocentrum pleurale would bear the chevron bone, and the present intercentrum would become the centrum. We would then have in the caudal region of Archegosaurus and Cricotus, the remarkable state of affairs of two true centra present, one of which has an intercentrum coössified with it, and the other supports the neural arch. The same would be the interpretation of the dorsal structure in Cricotus. As there is no direct evidence of such structure in the vertebral regions mentioned, nor in the caudal region of the Pelycosauria, its assumption appears to me to be the least probable alternative before us. Under this interpretation we have to regard the pleurocentrum as either vanishing, or becoming coössified with the intercentrum (m., hypocentrum) in the vertebral centra of existing Batrachia, which would then consist of four elements each, viz., two pleurocentra, hypocentrum pleurale, and intercentrum (hypocentrum), in the caudal region at least. Of this no evidence can be obtained from embryos of a length of 25mm and over. In Reptilia the centrum would consist of pleurocentrum and intercentrum (hypocentrum) combined, a division of which we have no evidence in the embryology of the vertebral column in these animals. In the divided caudal centra of the lizards one might see intercentrum (hypocentrum) and pleurocentrum, but this supposition is not necessary to account for this structure. I have observed above, that the evidence furnished by the vertebræ themselves is in favor of this division having arisen in the middle of a true centrum. The chief objection to this interpretation of the reptilian centrum is, however, to be found in the column of Cricotus, where we find the large bodies which bear the chevron bones, in the process of extinction, leaving behind bodies which are homologous with the centra of the Pelycosaurian reptile. And this is equally true, whether we regard the hypocentrum or the hypocentrum pleurale as the intercentrum, for it is the pleurocentra which remain, to be the true centra of Cricotus.

Thus on either of the assumptions just mentioned, the development of the dorsal part of the vertebral column in Cricotus is in an opposite direction to that stated by Fritsch to characterize the Sphenosauridæ. This is the main point to be proven. If further I have shown that the larger dorsal bodies of Cricotus are homologous with the centra of the Pelycosauria and Lacertilia, the proposition remains proven that the inferior vertebral bodies of the Rhachitomi and the entire vertebral bodies of existing Batrachia, are intercentra and not centra.

In order that the result shall be otherwise, it will be necessary to make the extreme assumption, that in Cricotus the two vertebral bodies represent hypocentrum pleurale (bearing chevron), and hypocentrum, the pleurocentrum having disappeared. The reader can judge which of the alternatives is the more probable, the disappearance of the insignificant hypocentrum pleurale, which only exists in distinct form in the Sphenosauridæ, or of the large pleurocentra which are so well developed in the Rhachitomi, and which in the caudal region of that order are almost identical with the bodies marked *ce* in Cricotus (Fig. 3). On this hypothesis we are led to the *reductio ad absurdum*, that the bodies which do not support the chevron bones in the caudal region of Eryops (Pl. I, Fig. 1 *c*), are not homologous with the bodies which do not support the chevron bones in the caudal region of Cricotus (Pl. I, Fig. 2 *c*–5) with which they are identical in position and connections.

Explanation of Plate I.

Figs. 1–6, two-thirds natural size; Figs. 7–10, natural size; Fig. 11, five times nat. size.

Fig. 1.—*Eryops erythroliticus* Cope (*Epicordylus* olim), proximal caudal vertebræ. The first intercentrum is the last one without chevron bone. From the Permian of Texas.

Fig. 2.—*Cricotus hypantricus* Cope, portions of the vertebral column of one individual, selected from the cervical (*a*), dorsal (*b*), and caudal (*c*), regions; left side. From the Permian of Texas.

Fig. 3.—The centrum of the anterior dorsal vertebra of 2*b*, from front, showing the hypantrum and hypantrapophyses. (Proceedings Amer. Philos. Soc., 1884, p. 29.)

Fig. 4.—Another dorsal centrum without neural arch, from front; *a*, from behind; *b*, from above, showing facet or neural arch.

Fig. 5.—Intercentrum from cervical region, showing rib attachment, from front; *a*, from behind; *b*, from the side; *c*, from above.

Fig. 6.—An intercentrum from the caudal region; *a*, from above.

Figs. 7 and 8, dorsal intercentra of *Cricotus heteroclitus* Cope, from Illinois; collection of W. F. E. Gurley.

Fig. 7.—Lateral view.

Fig. 8.—Front view of another intercentrum, the superior part broken away; *a*, lateral view.

Fig. 9.—*Clepsydrops natalis* Cope, a portion of the caudal region, showing ribs and chevron bones, from the side; fig. 9*a* from below, showing one free intercentrum, out of its place (*i*). From the Permian of Texas.

Fig. 10.—*Sphenodon guentheri* Buller; from New Zealand, caudal vertebræ, lateral view; *a*, an intercentrum with chevron bone from front. The reticulated portions are osseous tissue.

Fig. 11.—*Spelerpes bilineata* Green, larva, vertebræ, five times natural size, linear. 11*a*, Three cervical vertebræ, including atlas and connate centrum of proatlas; 11*b*, a dorsal vertebra; 11*c*, two sacral and two anterior caudal vertebræ; 11*d*, second caudal vertebra from behind. The caudal vertebræ show the continuity of the chevron bones. Specimen from the collection of Professor S. F. Baird.

Letters.

pra, proatlas, centrum.
i, intercentrum.
p, pleurocentrum.
c, centrum.
ch, chevron bone.
r, rib.
d, diapophysis.
pa, parapophysis.
poz, postzygapophysis.
ha, hypantrum.
hap, hypantrapophysis.
nc, notochordal foramen.
ff, foramina.
si, sacral intercentrum.
sc, sacral centrum.

ARTICLE III.

A CHEMICAL STUDY OF YUCCA ANGUSTIFOLIA.*

BY H. C. DE S. ABBOTT.

Read before the American Philosophical Society, December 18, 1885.

This plant is well known in the West as the "soap-weed." It grows very abundantly in most of the Western States and Territories. It has attracted the attention of botanists, and it is a plant of interest on account of the many uses to which it has been put in the countries where it is found.

The results noted in this paper are based upon a first and introductory chemical analysis of the *Yucca*. Previously, little has been studied of its chemistry. It is briefly mentioned in the work of a French writer, Dr. Georges Pennetier;† also, in a paper on the study of manganese found in the ash of plants in which M. Maumené states that the ash of the *Yucca* contains manganese.‡ He does not name what species of *Yucca* was examined. The former writer gives the micro-chemical characters of the action of iodine and sulphuric acid, dilute chromic acid, and cuprammonia on the fibres of the *Yucca angustifolia*.

The specimens of *Yucca* used in these analyses were of large growth and in good condition. The entire plant was examined, and a separate study made of the bark and wood of the root, and of the green leaf and the yellow basal part. The roots were air-dried, freed from adherent dust, reduced to a very fine powder, and passed through a No. 80 sieve. The leaves were less finely powdered.

Dragendorff's scheme for plant analysis§ has been generally followed. Ten grams of the air-dried powder were used for the preliminary examination of soluble substances. For every gram of the powder, ten c. c. of the solvents were employed. An additional quantity of the powder was prepared for special purposes. Five grams of the air-dried powder were dried, in a hot-air oven, at a temperature

* An abstract of this paper was read before the Chemical Section of the American Association for the Advancement of Science, at Ann Arbor, Michigan, August 28, 1885.

† Leçons sur les Matières Premières Organiques, Paris, 1881, p. 446.

‡ M. E. J. Maumené, Bul. de la Société Chimique de Paris. Tome xlii, p. 305.

§ Plant Analysis. Qualitative and Quantitative, by G. Dragendorff. Translated from the German by Henry Greenish, London, 1884.

between 100° C. and 110° C. until the weight remained constant, for the estimation of moisture. This powder was incinerated in a covered porcelain crucible at a dull red heat until the carbon was entirely consumed. The per cent. of total ash was determined from it.

QUALITATIVE ASH ANALYSES.

Calcium, magnesium, potassium, sodium, iron, manganese, chlorides, phosphates, and sulphates, were found in every part of the plant.

Determination of { I. MOISTURE / II. TOTAL ASH } on the powder.

	I.	II.	Color of Ash.
(1.) The bark of the root	6.78 per cent.	17.38 per cent.	reddish
(2.) " wood "	11.67 "	15.75 "	" gray
(3.) " green leaf.....	8.11 "	5.75 "	gray
(4.) " yellow base of leaf....	37.00 "	10.63 "	white

PETROLEUM SPIRIT EXTRACTS.

Extract (1) Bark of Root.

The maceration was conducted in an apparatus similar to one described in Dragendorff's "Plant Analysis."* A light petroleum spirit was used which boiled between 25° C. and 45° C. The *extract* was filtered from the powder-residue. It was a clear pale yellow-colored liquid, and slightly acid in reaction. A drop of the *extract* on evaporating left a uniform spot on blue paper. The *extract* was evaporated at the ordinary temperature. The *residue* was a solid, and it had the odor and characteristic crystalline structure of fatty acids, suggesting the presence of a fixed oil. Its melting point was taken. The substance melted at 60° C., and on cooling solidified amorphous. To determine the total amount of solids extracted, a definite volume of the *extract* was evaporated, dried, and weighed.

TOTAL SOLIDS.

Petroleum spirit residue dried at 100° C.....	1.24	per cent of solids.
" " " 110° C.....	1.20	" " "
	0.04	" " loss.

The *residue* was identified as a fixed oil. It was soluble in petroleum spirit, ether, benzole, chloroform, amyl alcohol, carbon di-sulphide, and cold aqueous alkalies; incompletely soluble in cold or boiling 86 per cent. alcohol, 95 per cent. alcohol, absolute alcohol, acetic ether, and ammonium hydrate. No change of color was

* Page 99, Tollen's apparatus.

observed on treating the fixed oil with concentrated sulphuric acid, nor on the addition of syrupy phosphoric acid, though it was partially soluble in these acids. Phosphoric acid colored it yellow; it was colored yellowish by concentrated hydrochloric acid and nitric acid of 1.22 specific gravity. A mixture of concentrated sulphuric acid and nitric acid of 1.22 specific gravity changed the color of the fixed oil to a reddish-brown; it was colored pale green by sulphuric acid of 1.634 sp. gr. and of 1.53 sp. gr. Calcium di-sulphide gave a bright green color reaction with the fixed oil, but did not form an emulsion with it; aqueous solutions of gold and platinum chlorides were reduced by it. The fixed oil was saponified with difficulty by alcoholic soda; but readily by boiling aqueous soda; a white fragile soap was separated and filtered from the liquid. The soap was decomposed by hydrochloric acid and the fatty acids separated. The filtrate from the soap was examined for glycerin. By the method* used, an oily liquid was obtained, it was heated with anhydrous borax on platinum foil, and gave the usual green-colored flame test for glycerin. The alcoholic solution of the *petroleum spirit residue* was fractionally precipitated with an alcoholic solution of magnesium acetate, and traces of an amorphous residue were recovered.†

The *petroleum spirit residue* was digested with water containing sulphuric acid, and examined for alkaloids which are sometimes brought down with fixed oils. The usual reagents failed to detect traces of alkaloids.

Extract (2), *Wood of the Root.*

The maceration was carried out under the same conditions as in *extract* (1).

The *extract* was a clear, colorless solution, neutral in reaction. A drop of the liquid left no uniform spot on blue paper. The *extract* was evaporated at the ordinary temperature. The *residue* was light yellow-colored, of a semi-solid consistency and melted at 36° C. A definite volume of the *extract* was evaporated, dried, and weighed.

TOTAL SOLIDS.

Petroleum spirit residue dried at 100° C	0.55	per cent of solids.
" " " 110° C	0.35	" " "
	0.20	" " loss.

The *residue* was identified as a fixed oil; associated with volatile fatty acids. The latter were indicated by the 0.2 per cent of loss, and the disagreeable odor of the *residue* which was dissipated on heating at 110° C.

The *petroleum spirit residue* from the *extract* was evaporated at the ordinary temperature, dissolved with difficulty in cold 95 per cent. alcohol, and in boiling weaker

* "Plant Analysis." G. Draggendorff, p. 12.

† Loc. cit., page 16.

alcohol; absolute alcohol hardened and discolored it. Concentrated sulphuric acid, nitric acid, and hydrochloric acid, did not appreciably act on the *residue.* It was not saponified, but slowly dissolved by boiling aqueous and alcoholic soda. The alcoholic solution of the *petroleum spirit residue* was submitted to a fractional precipitation with an alcoholic solution of magnesium acetate. The first precipitation obtained was purified by boiling alcohol; it was an opaque scaly crystalline solid which melted at 85° C. The second precipitation yielded traces of a white amorphous substance. The third precipitation resulted from adding strong ammonia water to the magnesium acetate solution, and the purified residue melted at 60° C.

Negative tests for alkaloids followed an examination of the aqueous treatment of the *petroleum spirit residue.*

Extract (3), *Green Part of the Leaf.*

The method of extraction was the same as that used in the previous extractions. The *extract* was clear, pale green in color, and non-fluorescent. It was colored by a small quantity of chlorophyll, which the petroleum spirit dissolved. The liquid was acid in reaction. A drop of it left a permanent stain on blue paper when evaporating. The *extract* was evaporated at the ordinary temperature, and the *residue* was a dark greenish-yellow semi-fluid substance. The solidifying point was taken. It was found to be about 15° C. A definite volume of the *petroleum spirit extract* was evaporated, dried, and weighed.

TOTAL SOLIDS.

Petroleum spirit residue dried at 100° C	2.20	per cent of solids.
" " " 110° C	2.01	" " "
	0.19	" " loss.

The *petroleum spirit residue* was identified as a fixed oil with a small amount of chlorophyll that had been brought into solution by it. It was soluble in cold 83 per cent. alcohol, 95 per cent. alcohol, absolute alcohol, amyl alcohol, ether, acetic ether, chloroform, benzole, carbon di-sulphide and glycerin. It was also soluble in oil of turpentine, almond oil, ammonium hydrate, mercuric chloride, and slowly soluble in acetic acid. Concentrated nitric acid, and hydrochloric acid slowly dissolved the fixed oil, the former colored it dark green, and on stirring the mixture the color was changed to a brown. Concentrated sulphuric acid dissolved and changed it to a very dark-brown color; on adding concentrated nitric acid, the liquid was changed to a reddish-brown color.

The following reactions were noted: The fixed oil changed to a hard greenish-yellow substance on heating it with anhydrous borax on platinum foil. When rubbed

on a crucible lid with powdered rosaniline, it was colored red, showing the presence of free fatty acids. It did not emulsify with calcium di-sulphide nor with syrupy antimony chloride, but it was colored dark-green by the latter. It was imperfectly dissolved by phosphoric acid, and slowly soluble in equal parts of cane sugar and concentrated hydrochloric acid; more rapidly soluble in equal parts of cane sugar and nitric acid. An aqueous solution of picric acid made alkaline by sodium carbonate colored the fixed oil a light reddish-brown color, cane sugar added to the solution facilitated dissolving it. It was instantly dissolved by equal parts of picric acid and acid ammonium phosphate, and on warming with stannous chloride, leaving a turbid yellow-colored liquid. It was insoluble in aqueous barium hydrate; soluble in alcoholic ammonia with no coloration, and in sulphurous acid. It was colored brown when mixed with sulphuric acid of 1.634 specific gravity, and incompletely dissolved; it was also colored brown by ferric chloride. On adding to the fixed oil sulphuric acid of 1.475 specific gravity, and a small quantity of zinc, hydrogen was generated, and the solubility of the oil in the acid liquid was accompanied by a rosy tint given to the solution.

Extract (4), *Yellow Part of the Leaf.*

This *extract* was obtained by a similar process as that used for the other petroleum spirit *extracts*. The *extract* was a pale yellow-colored liquid. The reaction was slightly acid. A uniform spot was left on blue paper as the drop evaporated. The petroleum spirit was evaporated at the ordinary temperature, and a yellow-colored *residue* recovered, of a semi-solid consistency and crystalline in structure. It solidified at 12° C. From a definite volume of the *petroleum spirit extract*, the amount of total solids was determined.

TOTAL SOLIDS.

Petroleum spirit residue dried at 100° C.	1.1	per cent of solids.
" " " 110° C.	1.1	" " "
	0.00	" " loss.

The *residue* was identified as a fixed oil. It was soluble in warm absolute alcohol, incompletely soluble in weaker alcohol; soluble in cold acetic ether, chloroform, benzole, amyl alcohol, ether, carbon di-sulphide, and glycerin. It was saponified with aqueous soda and a white soap separated. No reaction was observed with picric acid and ammonium phosphate, nor with nitric acid of 1.32 specific gravity and 1.18 specific gravity. The fixed oil was soluble in potassio-mercuric iodide solution; and colored dark-brown by alcoholic ammonia. A mixture of ferric chloride solution and powdered rosaniline gave a fine violet-colored reaction with the fixed oil.

An examination of the aqueous treatment of the *petroleum spirit residues* (3) and

(4), for alkaloids, gave negative results. A portion of the original powder, from each of the four parts of the plant, was mixed with an aqueous solution of caustic soda, and the distillate examined for volatile alkaloids with negative results.

SUMMARY I.

Petroleum Spirit Extracts.

	Solids extracted.	*Character of residue*	*Reaction with litmus.*	*Melting point.*	*Solidifying point.*
1. The bark of the root.. ..	1.24 per cent.	fixed oil	slightly acid	60° C.	solid at ordinary temperature
2. " wood "	0.55 "	" "	neutral	36° C.	
3. " green leaf.....	2.20 "	" " chlorophyll	acid	semi-fluid at ordinary temperature	15° C.
4. " yellow base of leaf..	1.10 "	fixed oil	faintly acid		12° C.

The solids extracted by petroleum spirit from the four parts of the plant are identified as fixed oils*; associated with a volatile principle (0.2 per cent) in *extract* (2), and with traces of chlorophyll in *extract* (3).

Fixed oil (1) was crystalline in structure. It was soluble in ether, chloroform, benzole, carbon di-sulphide, and amyl alcohol; incompletely soluble in cold or boiling alcohol, acetic ether, and ammonium hydrate. It was colored pale green by sulphuric acid of 1.634 specific gravity, and changed to a bright-green color by calcium di-sulphide, but formed no emulsion with it. Phosphoric acid colored it yellow. The fixed oil was saponified, and a white soap separated. This was decomposed, and the fatty acids recovered. Glycerin was separated from the soap filtrate.

Fixed oil (2) was dissolved with difficulty in boiling 95 per cent. alcohol, and hardened and discolored by absolute alcohol. It was not saponified. Crystalline solids were separated by precipitating the alcoholic solution with magnesium acetate. They melted at 85° C., and at 60° C., respectively.

Fixed oil (3) was soluble in alcohol, ether, chloroform, benzole, carbon di-sulphide, oil of turpentine, almond oil, glycerin, and slowly soluble in acetic ether. The presence of free fatty acids was demonstrated. The fixed oil was colored dark-green by syrupy antimony chloride; on adding to it sulphuric acid of 1.475 specific gravity, and a small quantity of zinc, hydrogen was generated, and the solubility of the oil in the acid liquid was accompanied by a rosy tint given to the solution.

Fixed oil (4) was crystalline in structure. It was soluble in warm absolute alcohol, in cold acetic ether, chloroform, benzole, amyl alcohol, ether, carbon di-sulphide, and glycerin. It was saponified, and a white soap separated. The fixed oil was colored dark-brown by alcoholic ammonia, and a mixture of ferric chloride solution and powdered rosaniline gave a violet-colored reaction with it.

*Fixed Oils. Science, Sept. 11, 1885.

These fixed oils differed in their physical characters and chemical reactions. This difference may be due to the presence of free fatty acids and glycerides in varying proportions in the four parts of the plant. It is of interest to note that in the subterranean part of the *Yucca*, the oil extracted from the bark was solid at the ordinary temperature; from the wood it was of a less solid consistency; while the yellow base of the leaf contained an oil quite soft, and in the green leaf the oil was almost fluid.

Extract (2) contained an oil of low melting point. It melted at 36° C. An alcoholic solution was fractionally precipitated with magnesium acetate, and three members of the fatty acid series were isolated. The quantities obtained were small, and it was impossible to do more than to take the melting point of two of the purified crystalline residues. They melted at 85° C., and at 60° C. respectively. It is a well-known fact that a mixture of fat acids in certain proportions has a lower melting point than those of its constituents.

Alkaloids and volatile-alkaloids were not detected in the *petroleum spirit extracts.*

ETHER EXTRACTS.

Extract (1), *Bark of the Root.*

The residual powder from the petroleum spirit extraction was dried until thoroughly freed from petroleum spirit. It was then macerated with Squibbs' stronger ether in the apparatus already described. The *ethereal extract* was filtered from the powder. It was a clear crimson-colored liquid, tinted by some red coloring matter dissolved; and acid in reaction. The *extract* was slowly evaporated at the ordinary temperature; white needle-shaped crystals were seen as the liquid concentrated. The *ethereal residue* was of a resinous character. It was ruby-colored, transparent, and of a softer consistency than ordinary resin. Microscopically, the *residue* was identified as a resin by its color reaction with Hanstein's aniline violet solution.* The *ethereal residue* was treated with petroleum spirit to remove any traces of fat that may have been extracted with it. It was heated in a small tube, at 50° C. it experienced a slight change, and melted at 70° C. For a determination of the total solids, a definite volume of the *ethereal extract* was evaporated, dried, and weighed.

TOTAL SOLIDS.

Ethereal residue dried at 100° C.	3.16 per cent of solids.
" " " 110° C.	3.16 " " "
	0.00 " " loss.

The resin was incompletely soluble in 95 per cent. alcohol, absolute alcohol, and

* Botanical Micro-Chemistry. Poulsen-Trelease. Boston, 1884, p. 59.

amyl alcohol; readily soluble in ether; not appreciably soluble in chloroform, benzole, and carbon di-sulphide. It was dissolved by sulphuric acid to a colorless solution, which, on warming, turned to a yellow color, and gradually darkened to a dull brown color, fading to a pale yellow.

An attempt was made to separate the white needle-shaped crystals mentioned above. The *ethereal residue* was agitated with acetic ether. The liquid was filtered from the insoluble matter and evaporated. Traces of a resinous substance were separated. The insoluble matter was treated with boiling ether, filtered hot, and the filtrate concentrated. On cooling, the white needle-shaped crystals reappeared. They were insoluble in water and in acetic ether.

A separate portion of the *ethereal extract* was evaporated, and treated with warm distilled water. The aqueous extract was made up to a definite volume, and a known quantity evaporated, dried, and weighed. The amount of total solids was almost inappreciable by weight. The aqueous extract was not colored by iron salts, and it did not form a precipitate with alum and gelatine solution, lead acetate, potassio-mercuric iodide, nor gold chloride solutions; showing absence of tannin, gallic acid, and alkaloids. The *ethereal extract* was directly tested for these compounds, and with negative results. A portion of the aqueous extract was evaporated to dryness, and treated with potassa solution, and the residue dissolved with no coloration. Another portion of the aqueous extract was agitated with acetic-ether, and the liquids were separated; on evaporating the acetic ether solution, traces of a residue were obtained which sulphuric acid acted upon. A resinous substance separated from the greenish-colored acid liquid, the former was partially disintegrated by cold water.

The specific gravity of the resin was 1.091.

Extract (2), *the Wood of the Root.*

The residual powder from the petroleum spirit extraction was macerated in stronger ether. The *ethereal extract* was of a reddish-yellow color; slightly acid in reaction. It was slowly evaporated at the ordinary temperature, and as the liquid concentrated, white needle-shaped crystals appeared, and presented the same physical structure as the crystals found in the *ether extract* (1).

The *ethereal residue* was identified as a resin. It was a transparent, ruby-colored substance, and acid in reaction. It was heated to 50° C., at that temperature its color deepened, and at 70° C. it melted. The specific gravity of the resin was 1.091. A definite volume of the *ether extract* was evaporated, dried, and weighed to determine the amount of total solids.

TOTAL SOLIDS.

Ethereal residue dried at 100° C.	1.70	per cent. of solids.
" " " 110° C.	1.45	" " "
	0.25	" " loss.

The resin was examined by Hirschsohn's scheme* with a view to classify it with known resins. It was imperfectly soluble in 95 per cent. alcohol and chloroform; soluble in ether. The alcoholic solution gave a turbidity with lead acetate, not cleared upon boiling, and with ferric chloride formed a clear mixture. Concentrated sulphuric acid dissolved the resin, leaving a dark yellow-brown liquid which faded to a dull yellow color. The sulphuric acid solution when mixed with alcohol, changed to a pale gray color. On addition of water to the acid solution, there was no coloration nor separation of the resin. Alcohol containing hydrochloric acid gave no color reaction with the resin. Bromine solution added to the chloroform-resin extract, and iodine solution to the ether-petroleum-resin extract, gave no reactions. Sodium carbonate at the ordinary temperature had no effect on the resin, but on boiling the liquid was colored yellow.

By the above examination, this resin was thrown out of the numerous classes of described resins. It is proposed to name it yuccal.†

Yuccal was soluble in boiling absolute alcohol and acetic ether; incompletely soluble in benzole, carbon di-sulphide, alcoholic ammonia, and cold acetic ether. The red color of the resin was removed by cold acetic ether, a transparent substance remaining, soluble in hot acetic ether.‡ Yuccal was dissolved by potassio-mercuric iodide. It reduced aqueous solutions of gold and platinum chlorides. A blood-red color reaction was obtained by warming a small quantity of the resin on a crucible lid with a crystal of ammonium molybdate and a few drops of nitric acid. On adding to the resin mixture a few drops of strong sulphuric acid, and again warming, it was dissolved. Warm dilute nitric acid dissolved the resin, colorless; cold nitric acid gave a brownish-green color reaction.§ Yuccal was heated on platinum foil, and as it decom-

*E. Hirschsohn. Watts Chem. Dict. Vol. viii, Pt. ii, p. 1743.

†I suggest that in future all resins be distinguished by the terminal syllable *al*, for uniformity of resin nomenclature. Yuccal; Science, September 11, 1885, p. 210.

‡I have examined the action of acetic ether as a solvent for resins. Cold acetic ether dissolved ordinary resin, turpentine, styrax, tolu-balsam, mastic, elemi, Canada-balsam, Peru-balsam, copaiba-balsam, Venice-turpentine, and incompletely spruce-gum, and yuccal. In hot acetic ether spruce-gum and yuccal were soluble. The following resins were insoluble in hot or cold acetic ether, guiacum, sandarac, shellac, benzoin, olibanum, ammoniac, myrrh, galbanum, and asafœtida.

§A reddish-yellow decomposition product resulted from the action of nitric acid on many resins which followed generally quite soon after adding the acid to a small quantity of the resin (0.1 gram of the resin and 5 c. c. of nitric acid 1.4 sp. gr.). But the reaction which took place varied according to the conditions, *i. e.*, strength of acid used,

posed the fumes that were given off were pleasant and aromatic. Tests failed to show the presence of benzoic or cinnamic acids.

The *ethereal residue* was treated with warm water, and on cooling, the liquid was agitated with acetic ether, which was separated, and when evaporated yielded a small quantity of resinous substance. The *ethereal residue* insoluble in water was treated with boiling ether, and as the liquid concentrated, the white needle-shaped crystals were seen floating in it, but on further concentration they could not be seen, and a yellow greasy-looking mass settled in the bottom of the beaker. On driving off the ether, a transparent and ruby-colored resinous substance remained. The aqueous extract obtained in the way described above gave no coloration with iron salts, and no precipitate with gelatine and alum solution, potassio-mercuric iodide, or gold chloride solutions. Fehling's solution was not reduced by boiling, though the aqueous extract was boiled with acid, then rendered alkaline before adding the copper test. The preceding tests gave negative results for gallic acid, tannin, alkaloids, and glucosides. A portion of the aqueous extract was acidified and agitated successively with different solvents, for glucosides, bitter principles, and alkaloids which may be removed from solution by this means. The acid liquid was then rendered alkaline with ammonia, and agitated successively with the same order of solvents that were used with the acidified liquid. No solids were separated by these methods. The *ethereal residue* insoluble in water was treated with alcohol; and yielded traces of a resinous substance. The residue insoluble in water and alcohol was not dissolved by ether, acids or alkalies.

Yuccal or the *ethereal residue* soluble in ether and alcohol was saponified, and the soap boiled with lead acetate. The yellow masses were collected on a filter and treated with boiling ether, and the filtrate was slowly evaporated. The residue was a granular solid. This substance was imperfectly purified by repeated boiling with ether, and a solid of crystalline structure obtained. It gave an acid reaction with litmus, and a red color with concentrated sulphuric acid. The acid dissolved a substance enclosing the crystals, leaving the structure of the latter uninjured and colored. Strong nitric acid dissolved the crystals with no coloration. They were soluble in absolute alcohol, amyl alcohol, benzole, chloroform, glycerin, and a solution of alcoholic soda; soluble in potassium iodide, potassium chromate, mercurous nitrate, cobalt nitrate, potassium ferro-and-ferri-cyanide solutions; insoluble in ammonia and aqueous alkalies.

the application of heat to the resin acid mixture, or the addition of solvents to the mixture. The more concentrated the acid the more rapid was the reaction. The application of heat also hastened the change, especially if a more dilute acid was used in the mixture. Some solvents acted like heat by increasing the energy of the reactions. Alcohol and ether were active solvents, and the reaction was attended by the escape of nitrous fumes from the combination of alcohol or ether and nitric acid. Chloroform and benzole were indifferent. Amyl alcohol acted feebly.

Yuccal was treated with spirit of different strengths, as a means of separating resin acids if any were present. It was treated with 85 per cent. spirit; an opaque brown substance was left undissolved, which was soluble in absolute alcohol; insoluble in ether, and colored brown by concentrated sulphuric acid. The color was not discharged by alcohol or ether. The 85 per cent. spirit solution was evaporated, and the residue treated with 50 per cent. spirit and a small quantity of a brown residue was insoluble. The 50 per cent. spirit solution on evaporating left a non-crystalline, transparent, reddish-colored solid; acid to litmus. It was colored cherry-red by concentrated sulphuric acid, and slowly dissolved to a yellowish-red liquid.

Extract (3), *the Green Part of the Leaf.*

The residual powder from the petroleum spirit maceration was thoroughly dried, and again placed in the percolator. It was treated with Squibbs' stronger ether. The *extract* was a deep-green colored liquid and fluorescent. The reaction was slightly acid. Alcohol, benzole, and petroleum spirit added to the *ethereal extract* did not cause a precipitation. An amorphous and green-colored residue was obtained on evaporating the *extract*. The amount of total solids was estimated from a definite volume of the *extract*, which was evaporated, dried, and weighed.

TOTAL SOLIDS.

Ethereal residue dried at 100° C.	1.25	per cent of solids.
" " " 110° C.	1.14	" " "
	0.11	" " loss.

The *ethereal residue* was brought into a state of fine division and treated with water. The amount of total solids soluble in ether and water was 0.34 per cent. The aqueous extract was neutral in reaction. It was faintly colored and slightly bitter to the taste. It was not colored by iron salts nor precipitated with alum and gelatine solution, showing absence of gallic acid or tannin. Copper solutions were not reduced, indicating absence of glucosides, though the precaution was observed of boiling the aqueous extract with acid and rendering alkaline before adding the copper solution. The aqueous extract was agitated with acetic ether and a distinctly crystalline residue separated. Under the microscope these crystals were white, needle-shaped and arranged in bundles. They did not respond to tests for gallic acid. Potash solution formed a yellow mixture with the crystals. The color was discharged by a drop of hydrochloric acid. Chloroform did not dissolve any substance from the *ethereal residue*. The *ethereal residue* was treated with acidulated water and tested negatively for alkaloids.

The *ethereal residue* insoluble in water was treated with alcohol. The amount of

substances insoluble in water, and soluble in ether and alcohol was 0.15 per cent. The alcoholic solution was evaporated, and the residue was crystalline in structure. Concentrated sulphuric acid imperfectly dissolved it, and gave a reddish-yellow color reaction; acetic ether discolored the solution. The alcoholic residue was insoluble in acetic ether, cold and boiling aqueous alkalies; soluble in chloroform. It saponified with alcoholic soda.

The amount of the *ethereal residue* insoluble in water and alcohol was 0.65 per cent. It was not soluble in alcoholic or aqueous soda. This would indicate a resin anhydride. Concentrated sulphuric acid gave no color reaction with it; and a mixture of sulphuric acid and cane sugar dissolved the residue.

The *ethereal residue* on treating with cold ether was not entirely soluble in it. It was soluble in chloroform, benzole, and carbon di-sulphide; incompletely soluble in cold alcohol, and insoluble in amyl alcohol. The *ethereal residue* was treated with 95 per cent. alcohol, in which it was slightly soluble. A turbidity formed in the alcoholic solution on adding lead acetate, ferric chloride, ammonium hydrate, and sulphuric acid; it did not clear up on warming. Hydrochloric acid made a muddy mixture with the alcoholic solution. The *ethereal residue* was not entirely soluble in acetic ether; the latter separated coloring matter from it. The *ethereal residue*, insoluble in acetic ether and freed from coloring matter (chlorophyll), was a resinous substance. It melted at 80° C. The resin was boiled with absolute alcohol, and on throwing the alcoholic solution into cold water it was precipitated as a white cloud. It was not saponified.

Extract (4), *Yellow Base of Leaf.*

The residual powder from the petroleum spirit maceration was dried and extracted with stronger ether. The *ether extract* was a turbid yellow liquid; slightly acid in reaction. On evaporating the *ethereal extract* at the ordinary temperature a reddish-yellow granular solid remained. It melted at 79° C. For the determination of total solids extracted, a definite volume of the *extract* was evaporated, dried, and weighed.

I.

TOTAL SOLIDS.

Ethereal residue dried at 100° C	1.7	per cent of solids.
" " " 110° C	1.7	" " "
	0.0	" " loss.

The *ethereal residue* was treated successively with distilled water, alcohol, and ether.

II.

Substances souble in ether and water	0.8	per cent.
" " " alcohol.	0.4	"
" insoluble in water and "	0.5	"
Total solids	1.7	"

The aqueous extract gave a neutral reaction with litmus. Negative results followed examination for tannin, gallic acid, glucosides, alkaloids, and any compounds containing nitrogen.

The *ethereal residue* (the *residue* insoluble in water) was an opaque reddish-yellow colored substance, and was identified as a resin. It melted at 79° C. It was insoluble in ether, benzole, chloroform, and acetic ether; incompletely soluble in cold absolute alcohol, amyl-alcohol, carbon di-sulphide, and oil of turpentine. It was soluble in aqueous and alcoholic soda. On boiling with them, it was saponified. Concentrated sulphuric acid dissolved the resin and colored it a yellowish-brown. Chloroform formed a turbid mixture with the acid solution. The action of strong nitric acid on the resin was slow. The resin was incompletely soluble in 95 per cent. alcohol. Lead acetate gave a cloudiness with the alcoholic solution which increased on boiling. Ferric chloride thickened the alcoholic solution, and on boiling it gave a yellow precipitate which was insoluble in acids, alkalies, absolute alcohol, and acetic ether. The chloroform extract gave no coloration with bromine solution.

SUMMARY II.

Ethereal Extracts.

	Solids extracted.	*Character of residue.*	*Reaction with litmus.*	*Melting Point.*	*Specific gravity*	*Substances soluble in ether and water.*	*Substances soluble in alcohol and water.*	*Substances soluble only in ether.*
1. The bark of the root.....	3.16 p. ct.	resin	acid	70° C.	1.091	traces	traces	.....
2. " wood "	1.70 "	"	slightly "	70° C.	1.091	"	"	.....
3. " green leaf.....	1.25 "	" chlorophyll	" "	80° C.	.....	0.34 p. ct.	0.15 p. ct.	0.65 p. ct.
4. " yellow base of leaf...	1.70 "	resin	" "	79° C.	.....	0.80 "	0.40 "	0.50 "

The residues from the *ether extracts* (1) and (2) of the bark and of the wood of the root contained resins which were identified as the same compound. They correspond in color, melting point, specific gravity, solubilities, and reactions. The resin is a transparent, ruby-colored substance, crystalline in structure, and of a softer consistency than ordinary resin. It was examined by Hirschsohn's scheme.* It differed from all described resins in its reactions with the reagents used to identify them. It is proposed to name it yuccal.†

Yuccal is imperfectly soluble in 95 per cent. alcohol; soluble in boiling absolute alcohol, in cold ether, and amyl alcohol; not appreciably soluble in chloroform, benzole, carbon di-sulphide, and alcoholic ammonia. Cold acetic ether dissolved the coloring matter from the resin, leaving a colorless solid. Hot acetic ether dissolved it perfectly. Yuccal when heated on platinum foil gave off as it burned a pleasant and aromatic

* Loc. cit.

† See foot-note, *ether extract* (2).

odor. Tests failed to show the presence of benzoic or cinnamic acids. A blood-red color reaction was obtained by warming yuccal with a crystal of ammonium molybdate and a few drops of strong nitric acid. Warm dilute nitric acid dissolved the resin, colorless; cold nitric acid gave a brownish-green color reaction. Yuccal was mixed with concentrated nitric acid and heated. After some time had passed, an energetic reaction occurred and nitrous fumes were given off. A yellowish-brown residue was one of the products of the reaction. This residue was almost insoluble in water, or acids. It was soluble in alcohol and potassium hydrate.*

As the *ether extracts* (1) and (2) were concentrated, white needle-shaped crystals appeared floating in the liquids, whose physical structure, and insolubility in water and acetic ether, suggested identical substances. The crystals separated from yuccal by the lead acetate method, already described, have not been sufficiently studied to identify them with the white needle-shaped crystals in the *ether extracts* nor with any class of chemical compounds. However, the absence of gallic acid, glucosides, and alkaloids in the aqueous extracts from the *ethereal residues*, would show that the crystals separated from yuccal are a constituent part of the resin.

The experiments with spirit of different strengths are only of value, so far as they were carried out, in showing the possibility of separating the resin into distinct parts.†

Tannin was not present in these *ethereal extracts.*

Ethereal extract (3) was green-colored and fluorescent from the chlorophyll of the leaves. On evaporating, the *ethereal residue* was amorphous and of a green color. The aqueous extract obtained from treating this *ethereal residue* was neutral in reaction and bitter to the taste. It contained neither gallic acid, tannin, nor glucosides. It was agitated with acetic ether, and the solvent removed a solid, which under the microscope proved to be white needle-shaped crystals arranged in bundles. Potash solution formed a yellow-colored mixture with the crystals, hydrochloric acid discharged the color. The subject has been too little studied to state definitely if these crystals are or are not identical with the crystals found in the *ethereal extracts* (1) and (2). But it should be noted, that unless the crystals from *Ethereal extract* (3) are brought into aqueous solution mechanically by some compound not present in *ethereal extracts* (1), and (2), the indications are in favor of the crystals from (3) not being identical with them; for the crystals from (1) and (2) were insoluble in water and not removed by acetic ether.

* See foot-note 3, *ether extract* (2).

† The amount of material on which these experiments, as well as others described in this paper, were tried, was too small in quantity for me to obtain more conclusive results. The facts which have been ascertained will serve as a guide in future investigations.

The *ethereal residue* was treated with acidulated water and tested negatively for alkaloids.

The *ethereal residue* insoluble in water was a mixture of two resins (I) and (II). The one (I) was dissolved by absolute alcohol, the other (II) was mostly soluble in ether. The alcoholic residue was crystalline. It was insoluble in acetic ether, but was saponified with alcoholic soda. The ether residue was a resin anhydride; it was insoluble in alcohol, and in alcoholic or aqueous alkalies.

The amorphous and green-colored *ethereal residue* was not entirely redissolved by cold ether. It was soluble in chloroform, benzole and carbon di-sulphide; incompletely soluble in cold alcohol, and insoluble in amyl alcohol. It was slightly soluble in 95 per cent. alcohol and in acetic ether. The latter separated the green coloring matter from it. The resinous mass insoluble in acetic ether melted at 80° C. It was not saponified. This resinous mass insoluble in acetic ether is a mixture of the two resins just described (I) and (II). It was noticeable that the resinous mass was not saponified. Resin (I) was saponified. Resin (II) did not saponify, and as this resin exceeded in amount by 0.5 per cent. resin (I), it would show that a certain percentage of resin anhydride in a mixture of two resins forbids the saponification of the mixture.

It was not determined if the crystals dissolved by water and separated by acetic ether were a part of resin (I) or resin (II) or an independent compound.

Ethereal extract (4) was a turbid yellow liquid. On evaporating, a reddish-yellow granular solid remained. The extract from the aqueous treatment was tested with negative results for tannin, gallic acid, glucosides, and alkaloids. The *ethereal residue* insoluble in water was identified as a resin. It was soluble in ether, benzole, chloroform, and acetic ether; incompletely soluble in cold absolute alcohol, amyl alcohol, carbon di-sulphide, and oil of turpentine. It was saponified. A resin was extracted by boiling absolute alcohol from the residual powder of the leaves (the yellow base) which was identified as the same resin, and the name of pyrophæal* was proposed for it.

I. Resins (1) and (2) are identical substances (yuccal).

II. *Ethereal residue* (3) is a mixture of two resins, and a crystalline principle soluble in water.

III. Resin (4) pyrophæal is identical with a resin found in *alcoholic extract* (4).

ALCOHOLIC EXTRACTS.

Extract (1), *Bark of the Root.*

The residual powder from the ether extraction was dried, and replaced in the percolator. The maceration was conducted at the boiling temperature of alcohol.

* Pyrophæal. Science, September 11, 1885.

Squibb's stronger alcohol was used. A dark red-colored liquid was extracted. It was neutral in reaction with litmus. The *alcoholic extract* was evaporated in a current of carbonic acid. The *residue* was non-crystalline and of a red color. A definite volume of the *alcoholic extract* was evaporated, dried until the weight remained constant, and the *residue* incinerated in a weighed platinum dish and the ash estimated.

I.

TOTAL SOLIDS.

Alcoholic residue dried at 100° C	9.25 per cent.
" " " 110° C	9.25 "
" " ash	0.2 "

The *alcoholic residue* was treated with distilled water, and a definite volume of the extract was evaporated, dried, and weighed. The *alcoholic residue* insoluble in water was treated with water containing ammonia (one part in fifty). This ammoniacal extract was evaporated with excess of acetic acid, and the residue rinsed with a little water on a filter, dried, and weighed. The dried aqueous extract insoluble in ammonia was then estimated.

II.

Distilled water residue	3.22 per cent.
Ammonia " "	5.43 "
Insoluble " "	0.60 "
Total solids	9.25 "

The aqueous extract from the *alcoholic residue* was studied as follows: It was not colored by a ferroso-ferric salt nor precipitated by gelatine and alum solutions, showing absence of gallic acid and tannin. A portion of the aqueous extract was acidified with sulphuric acid and agitated successively with petroleum spirit, benzole, chloroform, and amyl alcohol. The acidified liquid was rendered alkaline by ammonia and agitated with the solvents in the same order. Petroleum spirit removed from the acidified solution traces of an amorphous residue, soluble in sulphuric acid and caustic soda. Benzole and chloroform separated no substances from the solution. As the amyl alcohol solution was evaporating white needle-shaped crystals were seen floating in the liquid. On drying the residue they were decomposed and melted, leaving a dark-colored liquid. Several attempts were made to dry these crystals, without success. A few of the crystals were recovered from the solution, and tested for alkaloids; no reactions were obtained with the usual reagents for them.

Glucose was estimated from the aqueous extract. The liquid was heated over a water bath with Fehling's solution, and the precipitated red cuprous oxide was thrown upon a weighed filter, dried, and incinerated. The glucose was estimated gravimetri-

cally by calculating the amount of cupric oxide. It yielded 0.619 per cent. A portion of the aqueous extract was boiled with acid, neutralized, and heated over a water bath with Fehling's solution to calculate, by difference, saccharose or other reducible compounds, and by this method 0.18 per cent. was obtained.

The *alcoholic extract* was described as being deeply colored. This coloring principle* was completely precipitated by sub-acetate of lead. The lead precipitate was collected on a filter, suspended in water, and decomposed by sulphuretted hydrogen, filtered, and the filtrate freed from all odor. It was allowed to evaporate slowly over sulphuric acid. The residue was a brownish-gray mass, interspersed with fine crystals which radiated from a nucleus. The mass was weighed and gave 3.27 per cent. of solids. Another portion of the *alcoholic extract* was agitated with water and acetic ether. The coloring matter was taken up by the acetic ether, and on evaporating a red-colored substance was recovered. It was dried and weighed, yielding 2.2 per cent. This red-colored residue was perfectly soluble in cold water. This solution was tested with the following reagents: It gave with potassium bichromate a creamy-colored precipitate; ferric chloride, a yellowish-green precipitate; ferrous sulphate a reddish-brown precipitate; stannous chloride, no precipitate, a yellow cloudy liquid; alum, a cloudy solution; neutral acetate of lead, a slight precipitate. The red color of the coloring matter was brought out on addition of alkalies. It was destroyed by acids.

Extract (2), *Wood of the Root.*

The residual powder from the ether treatment was dried and macerated with Squibb's stronger alcohol. The *alcoholic extract* was neutral in reaction; when warm it was a clear reddish-golden-colored liquid. On cooling, a creamy-white solid settled at the bottom of the flask. This substance was soluble in water, and was identified as saponin by the usual tests for it. A definite volume of the *alcoholic extract* was evaporated in a current of carbonic acid, dried, and weighed. The residue was incinerated in a weighed platinum crucible for the ash determination.

TOTAL SOLIDS.

Alcoholic residue dried at 100° C	14.3 per cent.
" " " 110° C	14.3 "
" " ash	00.1 "

The *alcoholic residue* was treated with cold water in which it was soluble. A cloudy solution was formed, and on shaking, it became frothy, and presented the appearance of an emulsion. It was allowed to stand for several days to see if the resinous matter separated, but the emulsion was permanent, as no separation had

* A red crystalline coloring matter. Science, September 11, 1885.

taken place. The emulsified liquid was agitated with acetic ether, and this solvent readily separated most of the resin from the aqueous portion. The water extract was then evaporated to dryness and redissolved in water. Gelatine and alum solution did not precipitate the extract, showing absence of tannin; no coloration with iron salts, absence of gallic acid; negative results followed tests for alkaloids; the aqueous extract was boiled with potash and no ammonia fumes were formed; adding gold chloride, and potassio-mercuric iodide solutions to the extract gave no precipitate. A measured portion of the aqueous extract was acidified with sulphuric acid, and agitated successively with petroleum spirit, benzole, and chloroform. The solvents were evaporated; petroleum spirit removed 0.01 per cent of a resinous substance, imperfectly soluble in cold and boiling aqueous alkalies, dissolved by sulphuric acid with a red coloration; chloroform left a brownish residue which, on weighing, yielded 0.4 per cent. This residue was moistened with a few drops of concentrated sulphuric acid, and changed to a red-violet color characteristic of saponin.

A certain portion of the aqueous extract was rendered alkaline, and heated over a water bath with Fehling's solution. The precipitated copper was collected on a weighed filter, dried, and incinerated, and the glucose estimated gravimetrically from it. It yielded 1.592 per cent. Another portion of the aqueous extract was acidified, boiled, and potash added until the solution was alkaline to litmus paper, then the liquid was mixed with Fehling's solution and heated over a water bath. The percentage of saccharose or other substances which reduced the copper was calculated by difference. It amounted to 0.929 per cent.

The resin separated by acetic ether was an opaque substance, greenish-yellow in color, and insoluble in ether. The resin was dissolved in water and frothed on shaking. The emulsion in this case was not quite so permanent, as a slight resinous sediment settled after a time, possibly due to changes in the resin through oxidation.

Extract (3), *the Green Part of the Leaf.*

The dried residual powder was macerated by the aid of heat with Squibb's stronger alcohol. When warm the *alcoholic extract* was clear, but on cooling the solution became cloudy, and a creamy-white fine precipitate settled. The *alcoholic extract* was neutral in reaction. It was evaporated in a current of carbonic acid, dried, and weighed. A certain part of the residue was incinerated and the ash determined.

TOTAL SOLIDS.

Alcoholic residue dried at 100° C.	3.80 per cent.
" " " 110° C.	3.80 "
" " ash	0.15 "

The *alcoholic residue* was treated with cold distilled water. It had a slightly acid reaction with litmus. An emulsion was formed on the addition of water to the *alcoholic residue*. A measured quantity of it was evaporated, dried, and weighed. It amounted to 3.4 per cent., 0.4 per cent. of the *alcoholic residue* was insoluble in water. Tannin, gallic acid, and alkaloids were tested for and with negative results.

The liquid from the aqueous treatment of the *alcoholic residue* was rendered alkaline, and boiled with Fehling's solution, and there was no reduction. Boettger's bismuth test was also tried and with negative results. The aqueous portion was boiled with acid and examined in the usual way for glucosides; the results were negative.

One volume of the aqueous solution was mixed with three volumes of stronger alcohol. It was placed on ice, and after some time a white precipitate formed. The precipitate was collected and dissolved in water. It frothed on shaking. On addition of a concentrated solution of caustic baryta, a creamy-white precipitate of saponin-baryta was obtained. Sulphuric acid gave the usual red-violet color reaction with the precipitate from the alcoholic aqueous solution.

The method of successive agitation of an aqueous extract with solvents already described was followed. Petroleum spirit on evaporating left a resinous substance. The residue separated by chloroform from an acidified solution was a brownish-colored substance. It was soluble in water, and frothed on shaking. It was colored red-violet by sulphuric acid, and the aqueous solution was precipitated by barium hydrate. Chloroform separated a brownish solid from an alkaline aqueous solution. It was precipitated by barium, colored red-violet by sulphuric acid, and its aqueous solution frothed on shaking. This brownish residue was identified as saponin.

Extract (4), *the Yellow Base of the Leaf.*

The residual powder, dried from all traces of ether, was macerated with hot alcohol. The *alcoholic extract* was a currant-colored liquid, and slightly acid in reaction. The liquid became clear on standing, and a creamy-white solid, identified as saponin, separated from it. The *alcoholic extract* was evaporated, dried, and weighed, and the ash of the residue was estimated.

TOTAL SOLIDS.

Alcoholic residue dried at 100° C.	4.30 per cent.
" " " 110° C.	4.30 "
" " ash	0.05 "

The *alcoholic residue* was treated with cold distilled water. The solution was slightly colored, and faintly acid in reaction. The absence of gallic acid, tannin, and alkaloids, was determined by negative results with iron salts, gelatine and alum solu-

tion, gold chloride, and potassio-mercuric solutions. Acetate of lead caused no precipitation. Fehling's solution detected a trace of glucose.

An imperfect emulsion formed on adding water to the *alcoholic residue.* Upon standing, the resin settled; the liquid was filtered several times, and the greater part of the resin collected. It was an opaque reddish-yellow-colored substance. It had the same melting point (79° C.), solubilities, and physical appearance as the resin of *ether extract* (4). The resin was examined by Hirschsohn's scheme. It differed in character from the many resins described by that author, and it is proposed to name it pyrophæal.*

Pyrophæal was slightly soluble in ether, and 95 per cent. alcohol; soluble in benzole, chloroform, and acetic ether; incompletely soluble in cold absolute alcohol, amyl alcohol, carbon di-sulphide, and oil of turpentine. It was saponified with aqueous and alcoholic soda. The ethereal resin solution was cloudy. The alcoholic resin solution gave a precipitate with lead acetate which did not disappear on boiling; ferric chloride and aqueous ammonia formed turbid mixtures with it. The chloroform resin solution was not affected by bromine solution. The petroleum-ether-resin solution turned to a turbid mixture on adding iodine solution. Alcohol containing hydrochloric acid was not colored by the resin. Sulphuric acid and alcohol gave a turbid brown mixture with it, and sodium carbonate solution was colored pale brown when cold or on warming.

SUMMARY III.

Alcoholic Extracts.

	Solids extracted.	*Character of residue.*	*Reaction with litmus.*	*Quantitative estimation of glucose.*	*Quantitative estimation of saccharose or other reducible compounds.*
1. The bark of the root.....	9.25 p. ct. 0.20 p. ct. ash	red coloring matter crystalline	neutral	0.619 p. ct.	0.180 p. ct.
2. " wood "	14.30 " 0.10 "	resin, saponin	"	1.592 "	0.929 "
3. " green leaf.....	3.80 " 0.15 "	resins, "	"	none	none
4. " yellow base of leaf.....	4.30 " 0.05 "	resin, "	slightly acid	traces	traces

Extract (1).

My attention was not directed to the presence of saponin in *extract* (1), for the characteristic properties which it imparted to *extracts* (2), (3), and (4), were absent; but, it was evident that saponin was present in the bark, for on boiling the latter in distilled water, the presence of the compound was indicated. The solution frothed on shaking, and by adding a concentrated solution of caustic baryta, saponin-baryta was precipitated.†

* Pyrophæal. Science, September 11, 1885.

† Saponin in the bark of *Yucca angustifolia.* Science, September 11, 1885.

A coloring matter* contained in the bark was extracted, and imparted to the *alcoholic extract* a brilliant red color. It was precipitated by sub-acetate of lead, and the lead precipitate suspended in water and decomposed by sulphuretted hydrogen. The lead sulphide filtrate was evaporated over a water bath until the odor of sulphuretted hydrogen was expelled, and the concentrated liquid was placed over sulphuric acid to evaporate slowly. A crystalline residue was obtained. On addition of alkalies to the colorless lead sulphide filtrate the red color of the original solution was developed. Acid discharged the color. Acetic ether took up the red colored substance. The acetic ether residue was a red uniform solid, and soluble in water. It was precipitated from the aqueous solution by sub-acetate of lead, potassium bichromate, ferric chloride, ferrous sulphate, and it was clouded by alum, and stannous chloride solutions.

Tannin, gallic acid, and alkaloids were absent.

Amyl alcohol separated from the acidified aqueous extract white needle-shaped crystals. It was not determined if these crystals were the same as those of the coloring matter.

Extracts (2), (3), *and* (4).

Extracts (2) and (3) when warm were clear, and on cooling a creamy-white solid separated. Extract (4), if warmed, was turbid, and as the liquid cooled, a creamy-white substance remained at the bottom of the flask, and the supernatant fluid became clear. This creamy-white substance was identified in each of the *extracts* as saponin.†

The results following an aqueous treatment of *alcoholic residues* (2) and (3), were noticeable. The *residues* were dissolved, and by shaking the mixtures, emulsified. This emulsion was permanent, as no resinous matter separated on standing several days. The emulsion was agitated with acetic ether, and by this means, most of the resin and saponin were separated from the aqueous portion. The saponin was removed mechanically with the resin, as it is almost insoluble in acetic ether. The resin-saponin mass was insoluble in ether, soluble in water. The solution frothed on shaking and emulsified, but the emulsion was not so permanent as in the first case, for a resinous sediment settled after a time. Chloroform separated saponin from an acidified aqueous solution, and also from an alkaline aqueous solution of the *residues;* and the red-violet saponin reaction with concentrated sulphuric acid was obtained.

The solubility in water of the *alcoholic residues* (2), (3), and (4), and the resulting emulsion were unusual, and explicable by the facts collected from a series of ex-

* A red crystalline coloring matter. Science, September 11, 1885.

† Saponin in the wood of the root and leaves. Science, September 11, 1885.

periments with resins and saponin, since I had successfully emulsified resins with aqueous and alcoholic saponin solutions.*

By hot alcoholic treatment the *yucca* yielded a residue of saponin and resin which became emulsified on the addition of water, giving results identical with those of the resins above described.†

Extract (4) contained a resin. It was an opaque reddish-yellow colored substance, and it differed, by its reactions, from the many resin classes given in Hirschsohn's scheme. It is proposed to name it pyrophæal.‡ A resin having the same melting point, solubilities, physical appearance, and chemical reactions, was discovered in the *ethereal extract* (4). It was identified as the same compound for which the name pyrophæal is proposed.

Tannin, gallic acid, and alkaloids were not detected in *extracts* (2), (3), and (4). In *extract* (3) glucose was not found.

The Solids of the Alcoholic Extracts.

I. A red coloring matter (crystalline).
II. A new resin (yuccal).§
III. A second new resin (pyrophæal).§
IV. A mixture of a crystalline resin and a resin anhydride.
V. Saponin.§
VI. Glucose, and saccharose or other reducible compounds.
VII. Ash.

AQUEOUS EXTRACTS.

Extract (1), *Bark of the Root.*

The residual powder was thoroughly dried from alcohol. It was returned to the percolator, and cold distilled water added until a definite amount had been used. The *aqueous extract* was dark colored, and of a faintly acid reaction. A certain quantity of the *extract* was evaporated, dried, and weighed. From a known weight of the *aqueous residue*, the ash was calculated. The incineration was conduced in a covered porcelain crucible of known weight.

*The same kinds of resins were used in these experiments as in those with which I determined the solubility of resins in acetic ether. See foot-note (2), *ethereal extract* (2).

† It was not until a later date following the time of these experiments that I found a reference to saponin-resin emulsion in L'Officine ou Répertoire General de Pharmacie Pratique, par Dorvault. Huitième Edition, Paris, 1872, p. 816. Also, refer to examination of the *Yucca angustifolia*, by H. C. De S. Abbott, published in the Medical and Surgical Reporter, Philadelphia, September 12, 1885, page 301.

‡ Pyrophæal, loc. cit.

§ Science, September 11, 1885, page 210. Abstract of a paper on the chemical study of *Yucca angustifolia*, by H. C. De S. Abbott.

TOTAL SOLIDS.

Aqueous residue dried between 100° C and 110° C.	4.00 per cent.
" " ash.	2.65 "

Gum.

One volume of the *aqueous extract* was mixed with two volumes of Squibb's stronger alcohol. The mixture was kept in a cool place for twenty-four hours, and the precipitate which had formed was collected on a weighed filter, washed with 66 per cent. alcohol, dried, and weighed. The precipitate and filter were incinerated in a weighed porcelain crucible, and the weight of the filter being deducted, the percentage of ash was determined.

Weight of precipitate by stronger alcohol yielded	2.0 per cent.
" " ash yielded	0.2 "

Another portion of the *aqueous extract* was precipitated by stronger alcohol, and the precipitate consisted of gum and albuminous substances. It was incompletely soluble in water. The soluble matter was gum, it was recovered from solution by evaporating the liquid to dryness. The gummy residue was almost completely soluble in cold water. It was precipitated from a concentrated aqueous solution by stronger alcohol; basic acetate of lead precipitated it as a flocculent precipitate. Borax did not thicken the gum solution, and ferric chloride and sodium chloride solutions did not precipitate it. The gum was boiled with dilute acid, and heated over a water bath with Fehling's solution which it reduced. A few drops of hydrochloric acid and stronger alcohol were mixed with the concentrated gum solution for the separation of arabin. It was not separated.

Carbhydrates.

The filtrate and wash alcohol from the gum precipitate were mixed, and evaporated to a syrupy consistency at a temperature of 70° to 80° C. The concentrated solution was treated with four volumes of stronger alcohol, and the resulting precipitate of *carbhydrates* rapidly filtered off. It was soluble in water. It was not precipitated from aqueous solution by basic acetate of lead, and by this means it was distinguished from vegetable mucilage. The *carbhydrates* were boiled with dilute acid, and the solution was rendered alkaline, and heated over a water bath with Fehling's solution. The latter was reduced. The percentage of *carbhydrates* as estimated, amounted to 0.2 per cent. An aqueous *carbhydrate* solution was mixed with a solution of barium in 40 per cent. alcohol. It yielded no precipitate.

Carbhydrate Filtrate.

The *carbhydrate filtrate* was concentrated at a low temperature in a current of carbonic acid until the alcohol was dissipated. The *residue* was examined for glucose, organic acids, saponin, and tannin. Traces of glucose were detected qualitatively by Fehling's test; the amount of cuprous oxide present was too small to estimate gravimetrically. A part of the *carbhydrate filtrate residue* was boiled with 83 per cent. alcohol, and filtered while hot. On cooling, a precipitate formed. This precipitate was identified as saponin. It was almost insoluble in stronger alcohol. Baryta-water precipitated it from aqueous solution. Its aqueous solutions frothed on shaking. When agitated with chloroform and on evaporating the chloroform solution, a light-colored residue was obtained. A few drops of concentrated sulphuric acid mixed with it gave a reddish-violet color reaction. Another portion of the *carbhydrate filtrate residue* was precipitated with neutral acetate of lead and filtered. The precipitate was suspended in water, decomposed by sulphuretted hydrogen, and the lead sulphide filtrate evaporated over a water-bath to expel all odor of sulphuretted hydrogen. The liquid was cooled and lime-water added until the reaction was alkaline to litmus. A turbidity formed when the lime-water was added to the filtrate, and was not entirely cleared on the addition of dilute acetic acid. A neutralized portion of the lead sulphide filtrate gave a yellow precipitate with a ferrous salt. Oxalic acid by these tests was indicated, and possibly other vegetable acids were present in the filtrate. The *carbhydrate filtrate residue* was examined for tannin, and with a negative result. Calcium oxalate was separated.

Extract (2), *the Wood of the Root.*

The powder used in the alcoholic maceration was thoroughly dried, and replaced in the percolator. A measured quantity of cold distilled water was allowed to percolate slowly through the powder. The *extract* was colored, and slightly acid in reaction. A definite volume of the *extract* was evaporated, dried, and weighed. A known weight of the *residue* was incinerated in a weighed covered porcelain crucible, and the ash determined. The ash was white and incompletely soluble in water.

TOTAL SOLIDS.

Aqueous residue dried between 100° and 110° C.	12.10 per cent.
" " ash	1.74 "

Gum.

A certain quantity of the *aqueous extract* was mixed with two volumes of stronger alcohol (Squibb's). The mixture was allowed to stand for twenty-four hours, and the

precipitate which formed was collected on a weighed filter. It was dried, and weighed. The precipitate and filter were incinerated in a weighed porcelain covered crucible, and the percentage of ash calculated.

Weight of precipitate by stronger alcohol yielded	1.70 per cent.
" " ash yielded	0.34 "

Carbhydrates.

The filtrate and wash-alcohol from the gum precipitate were concentrated at a low temperature, and the residue was mixed with four volumes of stronger alcohol. The precipitate was rapidly filtered off, and the percentage of *carbhydrates* calculated gravimetrically in the usual way, from the amount of cupric oxide reduced from Fehling's solution. It yielded 2.75 per cent.

Carbhydrate Filtrate.

A portion, representing a certain volume of the *aqueous extract*, of the *carbhydrate filtrate* was evaporated, dried, and weighed. It yielded 7.65 per cent. of the total solids of the *aqueous extract residue*. A known weight of the *carbhydrate filtrate residue* was dissolved in water and heated over a water-bath with Fehling's solution, and the amount of glucose present estimated gravimetrically from the weight of the cupric oxide. It was estimated as 4.47 per cent. Another portion of the *carbhydrate filtrate residue* was boiled with 83 per cent. alcohol. A precipitate formed on cooling, which was collected on a weighed filter, dried, and weighed. It yielded 1.98 per cent. The 83 per cent. alcohol precipitate was identified as saponin by the usual tests. The *carbhydrate filtrate residue* was precipitated by acetate of lead and the precipitate examined qualitatively for organic acids. The lead precipitate was decomposed by sulphuretted hydrogen and filtered, and the filtrate concentrated over a water-bath, and mixed with lime-water until turbid. The turbidity did not clear on adding dilute acetic acid.

The *aqueous extract* was examined for tannin, and with negative results. Calcium oxalate was present.

Extract (3), *the Green Part of the Leaf.*

The residual powder was dried from all traces of alcohol, and cold distilled water was allowed to slowly percolate through the powder. The *extract* was colored, and slightly acid in reaction. A definite volume of the *extract* was evaporated, dried, and weighed, and the ash calculated from incinerating a known weight of the *residue.*

TOTAL SOLIDS.

Aqueous residue dried between 100° C and 110°	4.35 per cent.
" " ash	0.40 "

Gum.

One volume of the *aqueous extract* was mixed with two volumes of stronger alcohol. The precipitate was collected after twenty-four hours, washed with 66 per cent. alcohol, dried, and weighed. The precipitate and filter were incinerated, and the ash estimated.

Weight of precipitate by stronger alcohol yielded	0.775 per cent.
" " ash yielded	0.125 "

Carbhydrates.

The gum filtrate and wash alcohol were concentrated at a low temperature, and the residual liquid mixed with four volumes of stronger alcohol. The resulting precipitate was rapidly filtered and collected. The percentage of *carbhydrates* was estimated gravimetrically from a copper solution in the usual way. It amounted to 0.525 per cent.

Carbhydrate Filtrate.

The *filtrate* was evaporated to dryness. A part of the *residue* was boiled with 83 per cent. alcohol. On cooling, a precipitate formed. It was identified by the usual tests as saponin. Another portion of the *residue* was precipitated with basic acetate of lead. The lead precipitate was decomposed by sulphuretted hydrogen, the solution filtered, and the filtrate evaporated over a water bath until all odor of sulphuretted hydrogen was dissipated. A part of the lead sulphide filtrate was mixed with lime-water, and a precipitate formed not completely dissolved by acetic acid. The remainder of the lead sulphide filtrate was allowed to evaporate over sulphuric acid. The residue consisted of a mass of fine crystals radiating from a centre.*

The crystals gave a very acid reaction when placed on moistened blue litmus paper. They turned black and left a residue when heated on platinum foil, and the residue was slowly dissolved by nitric or hydrochloric acid. The quantity of residue was very small, and no effervescence was observed. The melting point of the crystals was taken. A small quantity was placed in a tube with thin walls, and gradually heated; at 150° C. the substance sublimed, leaving a white, cloudy stain on the inner surface of the tube; at 190° C., this cloudy stain changed to a pale green spot, and with increasing temperature to 210° C., no further change was noted. Dry sodium carbonate was added to an aqueous solution of the crystals, and a slight effervescence was observed. Some iron was separated which possibly was in combination with the

* The material used in this analysis of the green part of the leaf was quite dry and powdered readily. A previous examination of the *fresh leaves* gave more satisfactory quantitative results. A gum was extracted which promises to be of interest for a future study, and the crystals separated from the lead sulphide filtrate are to be further investigated.

crystalline principle. Negative results followed tests for formates, acetates, malates, tartrates, citrates, phosphates, oxalates, alkaloids, and glucosides.

The amount of glucose present in the *aqueous extract* was too small to determine quantitatively. Negative results for tannin.

Extract (4), *the Yellow Base of the Leaf.*

The residual powder from the alcoholic maceration was dried and replaced in the percolator. Cold distilled water was allowed to percolate slowly through the powder. The *aqueous extract* was slightly acid in reaction. A known measure of it was evaporated, dried, and weighed. The ash was determined from a part of the *aqueous extract residue.*

TOTAL SOLIDS.

Aqueous residue dried between 100° and 110° C	11.35 per cent.
" " ash	3.10 "

Gum.

One volume of the *aqueous extract* was mixed with two volumes of stronger alcohol. The precipitate was collected, washed with 66 per cent. alcohol, dried, and weighed. The ash was calculated from incinerating the precipitate, and deducting the filter.

Weight of precipitate by stronger alcohol yielded	3.850 per cent.
" " ash yielded	0.676 "

Carbhydrates.

The filtrate and wash alcohol from the gum precipitate were concentrated at a low temperature. The residual liquid was mixed with four volumes of stronger alcohol, when a precipitate formed, and was rapidly filtered off. The *carbhydrates* were dissolved in water, boiled with dilute acid, and the liquid rendered alkaline and heated over a water bath with Fehling's solution. The amount of carbhydrates was estimated gravimetrically in the usual way. It gave 2.95 per cent.

Carbhydrate Filtrate.

The *filtrate residue* was examined for glucose, and traces of it were present. The *filtrate residue* was precipitated with acetate of lead, and the lead precipitate was dissolved in water and decomposed by sulphuretted hydrogen. The lead sulphide filtrate was tested qualitatively for organic acids, and a turbidity formed on adding to the filtrate lime-water. It was not completely cleared by acetic acid.

Negative results followed tests with alcoholic methyl-violet solution for mineral acids. The *aqueous extract* contained no tannin. Calcium oxalate was determined in it.

AQUEOUS MACERATION AT A TEMPERATURE OF 50° C. TO 60° C.

The Bark of the Root (1), *the Wood of the Root* (2).

The powder (1) used in the cold water extraction was macerated with distilled water heated between 50° and 60° C. The *warm aqueous extract* (1) was cooled and mixed with three volumes of stronger alcohol. A precipitate formed, it was dried, weighed, and the percentage estimated. It yielded 0.03 per cent.* The precipitate was dissolved in warm water. On evaporating the filtrate, a white residue was obtained. It was stained yellow by iodine.

The powder (2) from the cold water treatment was macerated in the warm water. The *warm aqueous extract* (2) was a dark colored liquid, indicating a coloring matter. A certain measure of the *extract* was evaporated, and the solids estimated. It amounted to 4 per cent. The percentage of solids precipitated from the *extract* by stronger alcohol was 0.25 per cent.

QUANTITATIVE ESTIMATION OF SAPONIN.†

The two methods of Christophsohn and Otten for the quantitative estimation of saponin were adopted. The wood of the root was examined.

A.—Ten grams of the original powder were boiled with distilled water. The saponin was precipitated by baryta-water. After weighing, it was ignited, and the baryta estimated as carbonate, calculated into oxide and deducted from the weight of the saponin-baryta, the difference being the weight of saponin.

B.—The saponin-baryta was decomposed by acid and the weight of the sapogenin was ascertained and calculated to saponin.

Several estimations were made on two specimens of the Yucca, collected at different times of the year.

Mean percentage, A ..... 8.95 per cent.
" " B ..... 10.40‡ "

SUMMARY IV.

Aqueous Extracts.

	Solids extracted	*Ash.*	*Gum.*	*Ash.*	*Glucose.*	*Saponin.*	
						A.	*B.*
1. The bark of the root.....	4.00 p. ct.	2.65 p. ct.	2.00 p. ct.	0.20 p. ct.	traces	.....	.....
2. " wood "	12.10 "	1.74 "	1.70 "	0.34 "	4.47 p. ct.	8.95 p. ct.	10.40 p. ct.
3. " green leaf	4.35 "	0.40 "	0.77 "	0.12 "	traces	.....	.....
4. " yellow base of the leaf..	11.35 "	3.10 "	3.85 "	0.67 "	"	.....	.....

* *Examination for Inulin*, page 87, Plant Analysis, G. Dragendorff. English translation.

† Loc. cit., page 68.

‡ Examination of the *Yucca angustifolia*, by H. C. De S. Abbott. The Medical and Surgical Reporter, Sept. 12, 1885, p. 301.

The *aqueous extracts* contained gum, albuminous substances, carbhydrates, glucose, saponin, organic acids, calcium oxalate, and no tannin, mineral acids, nor alkaloids. Arabin was not separated from gum (1). Calcium oxalate was brought into aqueous solution possibly by means of the organic acids or saponin. Needle-shaped crystals were found in *extract* (3). They did not respond to tests for formates, acetates, malates, citrates, tartrates, phosphates, oxalates, glucosides, and alkaloids.

Aqueous extracts of 50° C. to 60 °C. from the bark and wood of the root contained Inulin.

DILUTE CAUSTIC SODA EXTRACTS.

Extract (1), *the Bark of the Root.*

The residual powder insoluble in water was suspended whilst moist in a dilute soda solution (0.1 to 0.2 per cent). After twenty-four hours the mixture was filtered. One volume of the filtrate was acidified with acetic acid and mixed with three volumes of 90 per cent. alcohol, and allowed to stand in the cool. The precipitate was collected, washed with 75 per cent. alcohol, dried, and weighed, deducting ash. It consisted of mucilaginous substances and albuminoids.

Weight of precipitate by 90 per cent. alcohol yielded	0.85 per cent.
" " ash yielded	0.25 "

Lassaigne's test showed the presence of albuminous substances.

The filtrate and wash alcohol from the 90 per cent. alcohol precipitate was evaporated to dryness, and weighed, deducting the amount of soda acetate. It gave 0.24 per cent. The residue soluble in water was mixed with acetate of copper solution. A very small quantity of albuminous substances was precipitated by the reagent.

The albuminoids of the bark were estimated from the total nitrogen in one gram of the original powder. It yielded 4.75 per cent of albuminoids.

The powder insoluble in dilute soda solution was washed with distilled water. The liquid was deeply colored. It was evaporated, and the amount of solids estimated. It gave 1.3 per cent.

Extract (2), *the Wood of the Root.*

The powder insoluble in water was treated in the same way as in *extract* (1). The filtered solution was mixed with 90 per cent. alcohol in the manner described. The precipitate was estimated, deducting ash.

Weight of precipitate by 90 per cent. alcohol yielded	2.170 per cent.
" " ash yielded	0.256 "

The filtrate from the 90 per cent. alcohol precipitate was treated with water, and the soluble matter precipitated by copper acetate. The precipitate was collected, dried,

weighed, and ignited, the resulting oxide of copper being deducted. It yielded 0.104 per cent. of albuminoids. A current of washed carbonic acid was passed through the *dilute soda extract* to determine the presence of globulin (vitellin, myosin), and with negative results. The albuminoids were determined from the total nitrogen in the powdered wood. It amounted to 4.75 per cent. The total albuminoids in the leaves gave 9.62 per cent.

DILUTE HYDROCHLORIC ACID EXTRACTS.

Extract (1), *the Bark of the Root.*

The powder insoluble in dilute soda was washed with water and suspended in water containing 1 per cent. of hydrochloric acid. The absence of the blue color which the starch granules assume when treated with iodine solution was determined by examining the bark under the microscope; and consequently it was not looked for in the *extract*. A qualitative test showed the presence of calcium phosphate, and calcium oxalate. A measured quantity of the *filtrate* was neutralized with ammonia and mixed with three volumes of 90 per cent. alcohol. The precipitate was collected on a weighed filter, washed with 60 per cent. alcohol, dried, and weighed. It was incinerated, and the ash deducted from the precipitate.

The precipitate yielded	5.20 per cent.
" " " of ash	0.98 "
Organic substance	4.22 "

The filtrate from the 90 per cent. alcohol precipitate was evaporated. The residue was composed of ammonium chloride, from the reagents employed, and an organic substance having an odor like gum benzoin. It was agitated with ether and on evaporating the solvent a white residue with an odor like benzoin was obtained. Sulphuric acid gave a red color with it. The amount of this substance was calculated. It gave 0.45 per cent.

Extract (2), *the Wood of the Root.*

The insoluble powder from the dilute soda maceration was washed with distilled water, and suspended in water containing 1 per cent. of hydrochloric acid. The same means were used as in *extract* (1) to determine the absence of starch in the wood of the root. Parabin was also absent. Calcium oxalate was detected by qualitative tests. A similar method, as employed for its estimation in extract (1), was used to determine it quantitatively.

The precipitate yielded	0.305 per cent.
" " " of ash	0.155 "
Organic substance	0.150 "

Extract (3), *the Green Part of Leaf.*

The powder used in the dilute soda maceration was washed with distilled water and suspended in water containing 1 per cent. of hydrochloric acid. Iron and calcium phosphate were detected in the extract. The leaves were examined under the microscope, and a blue color was developed by an aqueous solution of iodine, indicative of starch granules. Starch was also present in the yellow base of the leaves.

TOTAL QUANTITATIVE RESULTS.

	(1.) *The bark of the root.*	(2.) *The wood of the root.*	(3.) *The green part of leaf.*	(4.) *The yellow base of leaf.*
1. Moisture	06.78 per cent.	11.67 per cent.	08.11 per cent.	37.00 per cent.
2. Total ash	17.38 "	15.75 "	05.75 "	10.63 "
3. Petroleum spirit extract	01.24 "	00.55 "	02.20 "	01.10 "
4. Ethereal extract	03.16 "	01.70 "	01.25 "	01.70 "
5. Alcoholic "	09.25 "	14.30 "	03.80 "	04.30 "
6. Aqueous "	04.03 "	16.10 "	04.35 "	11.35 "
7. Dilute soda "	01.09 "	02.41 "	.....	.....
8. Wash residue	01.30 "	.....	.....	.....
9. Dilute acid extract	05.65 "	00.30 "	.....	.....
Total percentage	49.88 "	62.78 "	25.46 per cent.	66.08 per cent.
Total albuminoids estimated on powder.	04.75 "	04.74 "	09.62 "	.....
Quantitative saponin determination on powder by *A* and *B*	.....	*A.* 08.95 per cent.	.....	.....
	.....	*B.* 10.40 "	.....	.....

In my paper on The Chemical Study of *Yucca angustifolia*, read at Ann Arbor, Mich., I stated what methods I had employed to separate saponin, and the properties of the compound as observed in that plant. Since which time a further study of it has induced me to withhold the notes used at Ann Arbor, from this, and to offer them, with those collected later, in a separate and more complete publication.

I am indebted to Dr. F. M. Endlich, for his courteous consideration and kindness in selecting and forwarding the fine specimens of *Yucca* which were used in these analyses, and which were grown in the neighborhood of Lake Valley, New Mexico. Within a few weeks I have received, in addition, several hundred pounds of the plant from Dr. Endlich.

The investigations described in the preceding pages were conducted in the chemical laboratory of the Philadelphia College of Pharmacy, from February to August, 1885.

ARTICLE IV.

SYSTEMATIC CATALOGUE

OF THE

SPECIES OF VERTEBRATA FOUND IN THE BEDS OF THE PERMIAN EPOCH IN NORTH AMERICA WITH NOTES AND DESCRIPTIONS.

BY E. D. COPE.

Read May 7, 1886.

PISCES.

SELACHII.

THORACODUS Cope ; Proceeds. Academy Philadelphia, 1883, p. 108.

1. *T. emydinus* Cope ; l. c., 109.

JANASSA Munster.

2. *J. gurleiana* Cope ; Proc. Amer. Phil. Soc., 1877, p. 191. Eastern Illinois.
3. *J. strigilina* Cope ; Amer. Naturalist, 1881, p. 163 ; *S. linguæformis* Cope ; Proc. Amer. Phil. Soc., 1877, p. 53, not of older authors. Eastern Illinois.
4. *J. ordiana* Cope. Texas.

ORTHACANTHUS Agass.

5. *O. gracilis* Newberry. Eastern Illinois.
6. *O. quadriseriatus* Cope ; l. c., p. 192. Eastern Illinois.

DIDYMODUS Cope ; Proc. Acad. Phila., 1883, p. 108 ; Proc. Amer. Phil. Soc., 1884, p. 572.

7. *D. texensis* Cope ; *D. ?compressus* Newb., Cope, l. l. c. c. Texas.
8. *D. platypternus* Cope ; l. c. Texas.

DIPNOI.

CTENODUS Agass.

9. *C. fossatus* Cope ; Proc. Amer. Phil. Soc., 1877, p. 54. Eastern Illinois.
10. *C. gurleianus* Cope ; l. c., p. 55. Eastern Illinois.
11. *C. periprion* Cope ; Proc. Amer. Phil. Soc., 1878, p. 527. Texas.
12. *C. porrectus* Cope ; l. c. Texas.
13. *C. vabasensis* Cope ; Proc. Acad. Phila., 1883, p. 110. East Illinois.
14. *C. dialophus* Cope ; Proc. Amer. Phil. Soc., 1878, p. 528. Texas.
15. *C. pusillus* Cope ; Proc. Amer. Phil. Soc., 1877, p. 191. Eastern Illinois.

PTYONODUS Cope ; Proc. Amer. Phil. Soc., 1877, p 192.

16. *P. vinslovii* Cope ; Proc. Acad. Phila., 1876, p. 410 Eastern Illinois.
17. *P. paucicristatus* Cope ; Proc. Amer. Phil. Soc., 1877, p. 54. Eastern Illinois.

GNATHORHIZA Cope ; Proc. Amer. Phil. Soc., 1883, p. 629.

18. *G. serrata* Cope ; l. c. Texas.

CERATODUS Agass.

19. *C. favosus* Cope ; Proc. Amer. Phil. Soc., 1884, p. 28. Texas.

TELEOSTOMI.*

ECTOSTEORHACHIS Cope ; Pal. Bull. No. 32, 1880, p. 19.

20. *E. nitidus* Cope ; l. c. Texas.

21. *E. ciceronius* Cope ; Proc. Amer. Phil. Soc., 1883, p. 628. Texas.

BATRACHIA.

GANOCEPHALA.

TRIMERORHACHIS Cope ; Proc. Amer. Phil. Soc., 1878, p. 524 ; 1880, p. 54.

22. *T. insignis* Cope ; l. c., p. 524. Texas.

23. *T. bilobatus* Cope ; l. c., 1883, p. 629. Texas.

RHACHITOMI.

ZATRACHYS Cope ; Proc. Amer. Phil. Soc., 1878, p. 523 et infra.

24. *Z. serratus* Cope ; l. c. et infra. Texas.

25. *Z. apicalis* Cope ; Amer. Naturalist, 1881, p. 1020, New Mexico.

ERYOPS Cope ; l. c., 1877, p. 188.

26. *E. megacephalus* Cope ; l. c. *Rhachitomus valens* Cope ; l. c., 1878, p. 526. Texas.

27. *E. erythroliticus* Cope ; l. c., 1878, p. 515 (*Epicordylus*) ; Trans. Amer. Phil. Soc., 1886, Pl. I, fig. 1. Texas.

28. *E. ferricolus* Cope ; l. c., 1878, p. 521 (*Parioxys*). Texas.

29. *E. reticulatus* Cope ; Amer. Naturalist, 1881, p. 1020. New Mexico.

ACHELOMA Cope ; Proc. Amer Phil. Soc., 1882, p. 455.

30. *A. cumminsi* Cope ; l. c., 456. Texas.

ANISODEXIS Cope ; l. c., 1882, p. 459.

31. *A. imbricarius* Cope ; l. c. Texas.

STEGOCEPHALI.

DIPLOCAULUS Cope ; Proc. Amer. Phil. Soc., 1877, p. 187 ; 1882, p. 451.

32. *D. salamandroides* Cope ; l. c., 1877, p. 187. Eastern Illinois.

33. *D. magnicornis* Cope ; l. c., 1882, p. 453. Texas.

EMBOLOMERI.

CRICOTUS Cope ; Proc. Acad. Phila., 1876, p. 405 ; Proc. Amer. Phil. Soc., 1884, p. 29.

34. *C. heteroclitus* Cope ; Proc. Acad. Phila., 1876, p. 405 ; Proc. Amer. Phil. Soc., 1884, p. 29 ; Trans. Amer. Phil. Soc., 1886, p. 247, Pl. I, figs. 7–8. *C. discophorus* Cope ; Proc. Amer. Phil. Soc., 1877, p. 186. Eastern Illinois.

35. *C. gibsoni* Cope ; Proc. Amer. Phil. Soc., 1877, p. 185. Eastern Illinois.

36. *C. crassidiscus* Cope ; Proc. Amer. Phil. Soc., 1884, p. 29 ; *C. heteroclitus* Cope ; l. c., 1878, p. 522 ; Amer. Naturalist, 1884, p. 39. Texas.

37. *C. hypantricus* Cope ; Proc. Amer. Phil. Soc., 1884, p. 30 ; Transac. Amer. Phil. Soc., 1886, p. 253, Pl. I, figs. 2–6. Texas.

* Owen ; Hyopomata Cope ; Teleostei et Ganoidei pars Müller.

REPTILIA.

THEROMORPHA.

Clepsydropidæ.

? Lysorhophus Cope ; Proc. Amer. Phil. Soc., 1877, p. 187.

38. *L. tricarinatus* Cope ; l. c. Eastern Illinois.

Archæobelus Cope ; Proc. Amer. Phil. Soc., 1877, p. 192.

39. *A. vellicatus* Cope ; l. c. Eastern Illinois.

Clepsydrops Cope ; Proc. Acad. Phila., 1876, p. 404.

40. *C. collettii* Cope ; l. c. p. 407. Eastern Illinois.

41. *C. vinslovii* Cope ; Proc. Amer. Phil. Soc., 1877, p. 62. Eastern Illinois.

42. *C. pedunculatus* Cope ; l. c., p. 63. Eastern Illinois.

43. *C. natalis* Cope ; Proc. Amer. Phil. Soc., 1878, p. 509. Texas.

44. *C. macrospondylus* Cope ; l. c., 1884, p. 35. Texas.

45. *C. leptocephalus* Cope ; l. c., 1884, p. 30. Texas.

Dimetrodon Cope ; Proc. Amer. Phil. Soc., 1878, p. 512 ; l. c., 1880, p. 42 et infra.

46. *D. gigas* Cope ; l. c., 1878, p. 513 ; l. c. 1880, p. 44. Texas.

47. *D. incisivus* Cope ; l. c. Texas.

48. *D. rectiformis* Cope ; l. c., p. 514. Texas.

49. *D. semiradicatus* Cope ; Bull. U. S. Geol. Surv. Terrs., 1880 (81).

Naosaurus Cope ; Amer. Naturalist, 1886, p. 545 et infra.

50. *N. cruciger* Cope ; *Dimetrodon cruciger ;* Proc. Amer. Phil. Soc., 1880, p. 44 ; Amer. Naturalist, 1878, p. 830. Texas.

51. *N. claviger* Cope ; Amer. Naturalist, 1886, p. 545 et infra. Texas.

52. *N. microdus* Cope ; l. c., 1886, p. 545 ; *Edaphosaurus microdus* Cope ; Proc. Amer. Phil. Soc., 1884, p. 37. Texas.

Theropleura Cope ; Proc. Amer. Phil. Soc., 1878, p. 519 , 1880, p. 40.

53. *T. retroversa* Cope ; l. c. Texas.

54. *T. uniformis* Cope ; l. c., 1878, p. 519 ; 1880, p. 40. Texas.

55. *T. triangulata* Cope ; l. c., 1878, p. 520. Texas.

56. *T. obtusidens* Cope ; l. c., 1880, p. 41. Texas.

Embolophorus Cope ; l. c., 1878, p. 518.

57. *E. fritillus* Cope ; l. c. Texas.

58. *E. dollovianus* * Cope ; Proc. Amer. Phil. Soc., 1884, p. 43, Pl. I, figs. 4–5. Texas.

Edaphosaurus Cope ; Proc. Amer. Phil. Soc., 1882, p. 448.

59. *E. pogonias* ; l. c., 449. Texas.

Pariotichidæ.

Pariotichus Cope ; Proc. Amer. Phil. Soc., 1878, p. 508.

60. *P. brachyops* Cope ; l. c. Texas.

61. *P. megalops* Cope ; l. c., 1883, p. 630, Texas.

Ectocynodon Cope ; l. c., p. 509.

62. *E. aguti* Cope ; l. c., 1882, p. 451. Texas.

63. *E. ordinatus* Cope ; l. c., 1878, p. 508. Texas.

64. *E. incisivus* Cope, infra. Texas.

Pantylus Cope ; Bull. U. S. Geol. Surv. Terr., 1881 (80).

65. *P. cordatus* Cope ; l. c. Texas.

*Dedicated to Dr. L. Dollo, the distinguished palæontologist of the Royal Museum of Brussels.

Bolosauridæ.

BOLOSAURUS Cope ; Proc. Amer. Phil. Soc., 1878, p. 506.

66. *B. striatus* Cope ; l. c. Texas.

CHILONYX Cope ; l. c., 1883, p. 631.

67. *C. rapidens* Cope ; l. c. Texas.

Incertæ sedis.

METARMOSAURUS Cope ; Proc. Amer. Phil Soc., 1878, p. 516.

68. *M. fossatus ;* l. c. Texas.

Diadectidæ Cope.

Pal. Bull. No. 32, 1880, p. 8.

DIADECTES Cope ; Proc. Amer. Phil. Soc., 1878, p. 505.

69. *D. sideropelicus* Cope ; l. c Texas.

EMPEDIAS Cope ; Proc. Amer. Phil. Soc. ; *Empedocles* Cope ; Proc. Amer. Phil. Soc., 1878, p. 516 ; 1880, p. 634.

70. *E. phaseolinus* Cope ; Pal. Bull. No. 32, 1880, p. 9. Texas.

71. *E. alatus* Cope ; l. c. Texas.

72. *E. latibuccatus* Cope ; l. c. Texas.

73. *E. molaris* Cope ; Pal. Bull. No. 32, 1880, p. 10. Texas.

74. *E. fissus* Cope ; Proc. Amer. Phil. Soc., 1880, p. 634. Texas.

HELODECTES Cope ; Pal. Bull. 11, No. 32, p. 11.

75. *H. paridens* Cope ; l. c. Texas,

76. *H. isaaci* Cope ; l. c., p. 12. Texas.

SYNOPSIS OF THE SPECIES.

PISCES.	*Gen.*	*Species.*
Selachii,	5	8
Dipnoi,	4	11
Teleostomi,	1	2
BATRACHIA.		
Ganocephala,	1	2
Rhachitomi,	4	8
Stegocephali,	1	2
Embolomeri,	1	4
REPTILIA.		
Theromorpha,	15	39
Total,	32	76

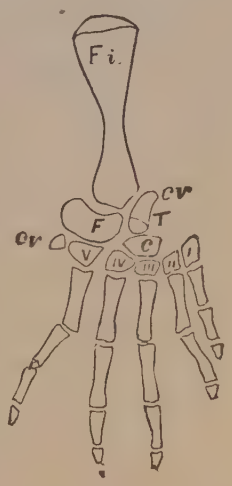
The only catalogue of this fauna hitherto published appeared in the American Naturalist for February, 1881, p. 162. In that list fifty-one species were enumerated.

CTENODUS VABASENSIS Cope ; Proc. Phila. Academy, 1883, p. 110.

Two fine teeth received from Mr. W. F. E. Gurley, from Danville, Illinois, probably belong to this species, their anterior crests being perfect. They are proven to be produced forwards as in *C. porrectus* Cope. One of the specimens agrees with

the type in the number of its crests, while the second, which is a little larger, has them $7\frac{1}{1}$ instead of $6\frac{1}{1}$.

ERYOPS PLATYPUS Cope. *Ichthycanthus platypus* Cope ; Proc. Amer. Phil. Soc., 1877, p. 574.



A reëxamination of the type specimen of this species from the Coal Measures of Ohio, preserved in the museum of Columbia College, New York, enables me to refer this species to the Rhachitomi. The neural spines are distinct, showing that it belongs, probably, to the Eryopidæ. As the skull is not preserved I cannot determine the genus positively, but refer it for the present to Eryops. I append a figure of the posterior foot, which displays the characters of the tarsus of this group for the first time. The number of tarsals is as in a Theromorph reptile, except that two elements represent the cuboid bone, as in the reptile *Stereosternum tumidum* Cope; giving five elements in the distal tarsal row. There is but one centrale and no intermedium. Two fragments of caudal vertebræ adhere to the specimen (marked *cv* in the accompanying cut). The lettering of the cut is as follows: *Fi*, fibula; *F*, fibulare; *T*, tibiale; *c*, centrale; I–V, tarsalia.

ZATRACHYS SERRATUS Cope; Proceedings of the Amer. Philos. Soc., 1878, p. 523; American Naturalist, 1884, p. 36.

This species has been thus far certainly known from a portion of the maxillary bone only. Analogy of general characters led me to associate with it a second species under the name of *Z. apicalis*. This form was clearly rhachitomous, so that in the American Naturalist, as above cited, I referred the genus Zatrachys to the family of the Eryopidæ.

A skull of the *Z. serratus* having come to hand, I am able to give some of its characters. These indicate that the position assigned to it as above is correct, and that it represents a genus different from any of the others of the family so far as our present understanding of the characters goes.

There are two approximated occipital condyles. There is no distinct basi-occipital bone distinguishable, and it is possibly wanting. The palatopterygoid arch is convex outwards, keeping near the maxillary bone, and separated from the parasphenoid by a wide foramen. The intercalare forms a prominent angle on each side of the cranial table. The occipital aspect of the skull displays fontanelles between two ascending portions of the exoccipitals, one of which bounds the foramen magnum, and the other the intercalare. The latter has a superior and inferior posterior angle which are sepa-

rated by a notch. The posterior part of the quadratojugal arch forms a wide roof or ledge overhanging the lower jaw. The teeth are small, acute, and close together. The median and anterior teeth are unknown, as the anterior half of the skull is wanting. The angle of the lower jaw projects little or not at all beyond the cotylus. The condyle of the quadrate is narrow and little distinguishable. Between the intercalare and the transverse process of the parasphenoid, is the deep tympanic chamber. It is traversed on one side of the specimen by a curved club-shaped bone, with the larger end truncate and internal. Its tissue is very spongy. It may be the columella auris, but its slender external extremity appears to be continuous with the os intercalare. This may, however, be due to the mode of preservation.

The surface of the skull has a dense reticulated sculpture, which is in places radiated. It is especially pronounced along the external border of the quadratojugal arch where it develops nodules which are arranged in a serrate manner. There is a pronounced fossa in front of each orbit, which is bounded within by a convex ridge extending forwards from the orbit. Between these ridges is another deep fossa of the middle regions, whose posterior border is in line with the anterior edge of the orbits. The cranial wall is here very thin. On each side of the supraoccipital bone a sharp process projects backwards and inwards forming a short horn. I do not imagine that the value of this character is more than specific. The external face of the mandible is sculptured, the sculptured surface presenting an obtuse angle upwards, and leaving a narrow smooth face anterior and posterior to the angle.

Measurements.	*M.*
Width of skull posteriorly,	.138
" between intercalare bones inclusive,	.062
" " occipital processes "	.019
" " orbits,	.039
Diameters of orbits { anteroposterior,	.017
Diameters of orbits { transverse,	.020
Elevation of occiput from foramen inclusive,	.010
Width of parasphenoid behind transverse processes,	.024

This cranium presents a curious mixture of defective and excessive ossification. Its form is more depressed than any others of the family. I await the discovery of its anterior regions with interest.

ECTOCYNODON INCISIVUS, sp. nov.

A nearly complete but somewhat distorted cranium represents this species. It presents the generic characters of roofed temporal fossæ, sculptured cranial bones without lyra, and an elongated tooth near the middle of the maxillary series.

The muzzle is quite prominent, a character somewhat exaggerated in the specimen by pressure. The nostrils are large, lateral in direction, and situated close to the end of the muzzle. The orbits are subround, of medium size, and look mainly upwards in the present condition of the specimen. One of the most important peculiarities of the species is the disproportionately large size of the first or anterior incisor or premaxillary tooth. The crown is conical and nearly straight, with an acute apex slightly posterior to the central point. Its section at the base is slightly angulate. The two other premaxillary teeth are much smaller, the third quite minute and with a sharp apex.

There are three maxillary teeth separated by rather wide interspaces anterior to the large tooth which gives character to the genus. The latter is abruptly large, but not equal in dimensions to the large first incisor. Posterior to it the maxillary teeth are closely placed, and with obtuse crowns. They commence very small, and increase in size posteriorly. At a point where the palatine or ectopterygoid, as the fact may be, joins the maxillary, the tooth-bearing surface is wide, and supports four rows of small obtuse-crowned spaced teeth of equal size. This dental patch is triangular, with its long angles extending anteriorly and posteriorly. The latter angle terminates a little posterior to the middle of the orbit. The teeth have a small axial pulp cavity, and the dentine is perfectly simple.

The head sculpture is well defined, and is reticulated in pattern.

Measurements.	*M.*
Length from end of muzzle to posterior border of orbit,	.054
Transverse diameter of orbit,	.016
" " " interorbital space,	.020
Length from end of muzzle to orbit,	.034
Vertical diameter of nostril,	.008
Vertical depth of maxillary in front,	.013
Length of first premaxillary tooth,	.0065
Transverse diameter of do.,	.0038
Distance between first incisor and large maxillary teeth,	.013
Distance from large maxillary tooth to posterior angle dental patch,	.024
Width of dental patch,	.0105
Elevation of a posterior tooth,	.0015

This species is intermediate in size between the *E. ordinatus*, which is small, and the *E. aguti*, which is large. In its disproportionate inequality in the size of its teeth, it differs from the latter; while the former has larger orbits and a different sculpture, besides having half the linear measurements. The sculpture of the *E. ordinatus* is in parallel ridges, enclosing minute deep punctiform pits between them.

The characters of this species confirm the propriety of my proposition that Pantylus, Ectocynodon and Pariotichus are members of a single family which differs from the Clepsydropidæ in the overroofing of the temporal fossa.*

DIMETRODON SPECIES.

My last account of this genus was published in the Proceedings of the American Philosophical Society, 1880, p. 42. Since that time additional material has enabled me to develop more fully the characters of this singular type.

Ribs.—In this genus and in Naosaurus the sacral ribs are present as in Batrachia. They are short, and vertically compressed, forming a wedge-like body.

Vertebræ.—I have at various times described the extraordinary development of the neural spines of the dorsal vertebræ in the genus Dimetrodon, which belongs to the Clepsydropidæ, one of the carnivorous families of the Saurian order Theromorpha. The dentition of these animals is of the most formidable character, consisting of compressed finely serrate teeth on the maxillary and dentary bones mingled with huge conic tusks on the middle of the maxillary anterior end of the dentary, and occupying the entire alveolar face of the premaxillary. The huge neural spines formed an elevated fin on the back. In a medium-sized specimen of *Dimetrodon incisivus*, where the vertebral body is 35 mm. in length, the elevation is 900 mm. or twenty and a half times as great. The apex of the spine in this species is slender, and apparently was flexible. Its utility is difficult to imagine. Unless the animal had aquatic habits, and swam on its back, the crest or fin must have been in the way of active movements. Accordingly the spines are occasionally found distorted by union of surfaces of fracture. The limbs are not long enough nor the claws acute enough to demonstrate arboreal habits as in the existing genus, Basiliscus, where a similar crest exists.

Sternum.—A singular bone which I can only regard as this element accompanies a fragmentary skeleton of the *D. incisivus* or *D. gigas;* and other examples occur with other specimens.

The anterior two-fifths of the bone is nearly square, and slightly concave above, with three angles, one at each side and one anterior; the rest contracts posteriorly into a long, narrow, flattened shaft, which constitutes three-fifths of the length. This portion is depressed, so that the transverse section is lenticular. The lateral edges are acute, and without articular facets of any kind. The distal extremity is first grooved, and then fissured, each half terminating in an obtusely narrow apex which is applied to the other half. The surface of this part of the element is longitudinally grooved both above and below.

* See Proceedings Amer. Philos. Soc., 1883, p. 631.

Clavicles.—The clavicles in the genus Dimetrodon are well developed elements. They consist of a vertical narrow and a horizontal expanded portion. The anterior border of the bone is rounded; the internal border is serrate or semidigitate. If the latter unites with the episternum by suture it must be by a very open one. This portion is more expanded than in the monotreme mammalia; while the episternum is more produced posteriorly. The type of structure of this part of the scapular arch is less mammalian than is that of Empedias above referred to, but is not far removed from the latter.

Posterior foot.—A posterior foot of a species of Pelycosaurian, from Ne Mexico, displays the characters more perfectly than any specimen in my collection. It confirms the inferences I have derived from the posterior foot of *Clepsydrops natalis* Cope, as to the mammalian affiliations of this order of reptiles. Thus it has the same number of tarsal bones distributed in the same manner. That is an astragalus and a calcaneum in the proximal series; then a navicular distad to the astragalus, which is succeeded by three cuneiform bones. Distad to the calcaneum is but a single bone, the cuboid. The specimen described differs in some important particulars from that of the species above mentioned. Thus the astragalus and navicular together are as long as the calcaneum, while in the *C. natalis*, the calcaneum and astragalus have equal lengths. It is possible that there are but four digits in the posterior foot; at least I can only find one metatarsal in connection with the cuboid. The internal edge of the astragalus is broken away, so that the presence of the spur or a homologous digit cannot be substantiated.

As the astragalus of Dimetrodon is closely similar to that of Clepsydrops, the species now described does not enter that genus. The rather numerous vertebræ which accompany it resemble, on the other hand, those of Theropleura, and it may be that they belong to a species of that genus. By comparison of the plate, with the cut given under the head of *Eryops platypus*, the difference between that type and this may be perceived.

The lettering of the figure is as follows: *As.*, Astragalus; *Ca.*, Calcaneum; *Cu.*, Cuboid; *Na.*, Navicular; *Enc.*, Entocuneiform; *Msc.*, Mesocuneiform; *Ecc.*, Ectocuneiform; I–IV, Metatarsals.

NAOSAURUS CLAVIGER Cope. American Naturalist, June, 1886.

Char. gen.—Naosaurus differs from Dimetrodon only in the presence of transverse processes on the neural spines.

The above named very peculiar species is congeneric with the Saurian described under the name of *Dimetrodon cruciger* Cope. The neural spines are not quite so ele-

vated as in the *D. incisivus*, but they are more robust, and have transverse processes or branches which resemble the yard-arms of a ship's mast. In a full-sized individual, the longest cross-arms, which are the lowest in position, have an expanse of two hundred and sixty millimeters, or ten and a quarter inches, while the spine has about the height of five hundred millimeters (19.75 inches), the body being 60 mm. long. The animal must have presented an extraordinary appearance. Perhaps the yard-arms were connected by membrane with the neural spine or mast, thus serving the animal as a sail, with which he navigated the waters of the Permian lakes.

The three species of Naosaurus differ as follows:

I. Neural spines distally cylindric.	
Distal transverse processes represented by tuberosities,	*N. cruciger.*
II. Neural spines distally dilated and compressed.	
Palatine teeth small, widely spaced,	*N. claviger.*
Palatine teeth large, closely packed,	*N. microdus.*

The skull.—One of the best preserved skeletons of the *N. claviger* includes a skull, but the extremity of the muzzle is unfortunately wanting. The median line rises forwards so that the convexity of the top of the muzzle is higher than the posterior parts of the skull, whose profile descends rapidly. This throws the orbit far back and gives the animal a peculiar appearance.

The orbit is nearly round, the superciliary border being arched. Anterior to it is a large anteorbital fossa bounded by a longitudinal ridge above. Above the ridge is a longitudinal groove, which is separated from that of the opposite side by a narrow ridge only. The quadrate bone is large and laminiform, and is truncate above, having a good deal the shape of the corresponding bone in a fish. The parietal buttress is produced downwards and backwards, and is in contact with the superior third of its posterior border. Beneath and within it is a narrow opisthotic. The pterygoid is large, and is distally vertically compressed. Anteriorly it becomes flattened so as to be horizontal, and is studded with small conical teeth rather distantly placed.

The transverse series of palatine teeth on a massive Z-shaped bone, seen in the *D. incisivus*, is not preserved in this specimen, but the explanation of the structure is furnished by a specimen of the *Dimetrodon semiradicatus* Cope, of which a second specimen has been found by Mr. Cummins. Here the palatine bones with their teeth are preserved. They are not so massive as in the *D. incisivus*. Posteriorly they pass into the longitudinally flattened part without interruption by suture, so that I suspect that this part is to be referred to the palatine rather than to the pterygoid bone. It is studded with small teeth, but they are not nearly so numerous as in the *N. cruciger*.

These specimens show that the species I named *Edaphosaurus microdus** must be placed in Naosaurus, where it represents the second species with transverse processes on the dorsal neural spines. The teeth of the palatine patch in this species are larger and more closely placed than in the *D. cruciger*. The distinction between the two species in the form of the apices of the neural spines, to which I referred in my description (l. c.) holds good; but the *N. claviger* has them dilated anteroposteriorly nearly as in the *D. microdus*.

Vertebræ.—A large series of these is preserved, and they show many interesting characters. The intercentra are not distinct in the anterior part of the column, but are separated posteriorly and in the sacrum. The centra are compressed and have an acute inferior heel. The neural spines are moderately compressed below the first transverse processes; above this point they are anteroposteriorly oval in section. The distal half is compressed. They expand to a point below the apex, where the anterior edge extends obliquely backwards to the summit. A short corresponding oblique edge truncates the posterior superior angle. The medullary cavity of the spine is not closed at the apex. On several of the vertebræ the lowest transverse process is double, but the sides of the same vertebra differ from each other in this respect in some instances.

The two sacral vertebræ are not coössified, and the zygapophyses are well developed and distinct, as are the intercentra. The latter are flat, and but little developed in the upward direction. The neural spines are rather elevated and slender. They are compressed without cross-processes, and the apex of the spine has small tubercles.

Ribs.—The ribs are long and well curved, and are moderately compressed on their proximal half, and cylindric for their distal. The head is well distinguished from the tubercle as in the manner of a mammal. That is, the tubercular surface is sessile on the convexity of the rib, and not pedunculate. In this respect these ribs differ from the usual form of two-headed reptilian ribs. The head is so long on the anterior dorsal vertebræ, as to articulate with the posterior edge of the vertebra in front of the one with which its tubercle articulates. It becomes shorter on the posterior parts of the column, articulating with the edge of the rib which supports the tubercle. On the caudal series the head is retracted so as to be close to the tubercular articulation, which is the most extensive, and which is deeply notched on one of its faces. This gives the appearance of a three-headed rib in this genus and in Dimetrodon.

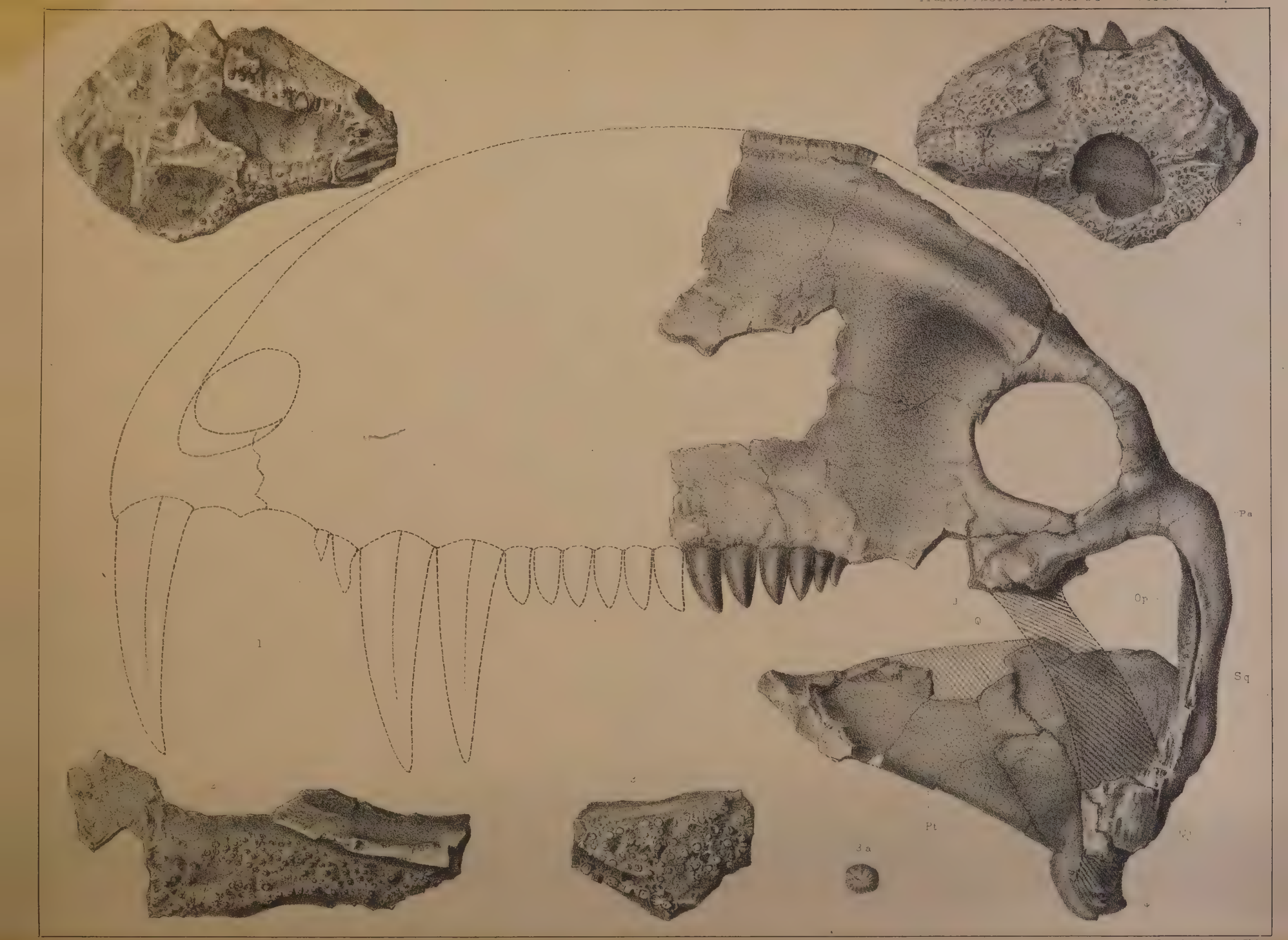
* Proc. Amer. Philos. Soc., 1884, p. 37.

Besides the skull, the vertebræ and the ribs, I cannot yet positively identify the skeleton of this species.

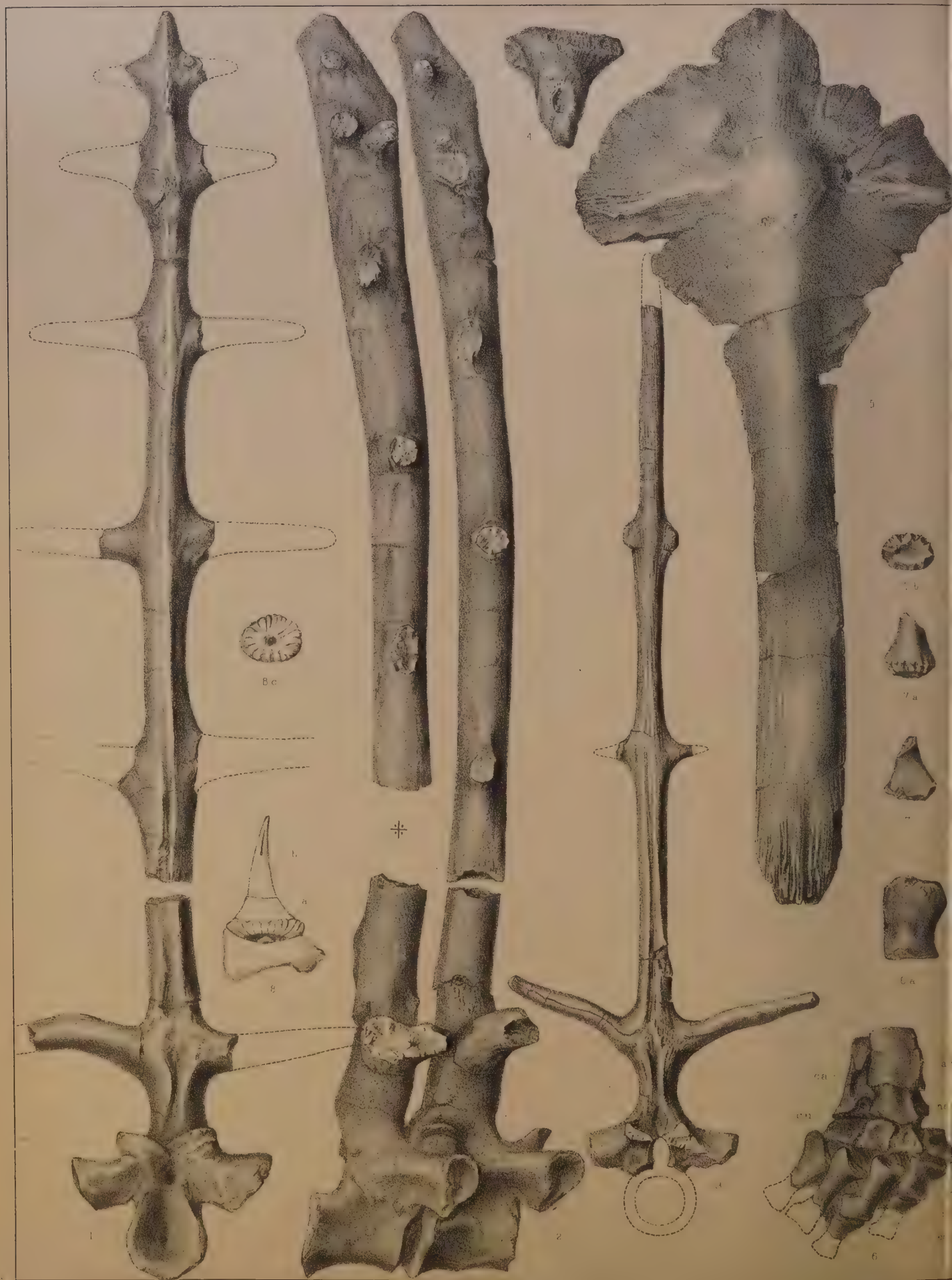
Measurements.	*M.*
No. 1. (Skull.)	
Depth of muzzle at sixth tooth from last,	.172
Length of skull posterior to same tooth,	.232
Diameters of orbit { anteroposterior,	.057
Diameters of orbit { vertical,	.056
Vertical depth from line of eyebrow to end of quadrate,	.200
Width of condyles of quadrate,	.050
Diameters of crown of sixth tooth { vertical,	.028
Diameters of crown of sixth tooth { anteroposterior,	.014
Diameters of crown of sixth tooth { transverse,	.011
Thickness of maxillary bone at sixth tooth,	.022
No. 2. (Vertebræ, probably of No. 1.)	
Diameters of dorsal neural arch, with zygapophyses { anteroposterior,	.064
Diameters of dorsal neural arch, with zygapophyses { transverse (posterior),	.036
Diameters of neural spine near base { anteroposterior,	.033
Diameters of neural spine near base { transverse,	.027
No. 3. (Vertebræ.)	
Diameters centrum dorsal vertebra { anteroposterior,	.039
Diameters centrum dorsal vertebra { transverse,	.034
Diameters centrum dorsal vertebra { vertical,	.035
Expanse prezygapophyses do.,	.041
" diapophyses do.,	.082
Elevation of neural spine to first process,	.024
Transverse diameter of process,	.025
Diameters neural spine at process { anteroposterior,	.030
Diameters neural spine at process { transverse,	.028
Length of the two sacral vertebræ,	.084
Elevation of neural canal of do.,	.010
" " " spine of do.,	.084
Length of rib on outside of curve,	.260
" " head of rib,	.045
Transverse diameter of rib just beyond tubercle,	.017
Anteroposterior do.,	.020

?SPUR OF A PELYCOSAURIAN.

In Plate III, fig. 7, is represented the basal part of a bone which has the form and characters of a metapodial of one of the Clepsydropidæ. It differs from all of these which have come under my notice in the burred or serrate character of the border of the proximal extremity. I do not know of any genus which is likely to have such a metapodial of the usual series. The first of the series, which articulates with



T. Sinclair & Son lith., Phila



1 NAOSAURUS CLAVIGER ½. 3. N. CRUCIGER ½. 4. N. MICRODUS ¾. 5. DIMETRODON ½.
6. THEROPLEURA ? ¾. 7. METAPODIAL ? 8. PLATYPUS.

the distal part of the astragalus has, however, not yet been discovered, and this bone may be that missing piece. Some probability attaches to this identification from the fact that the corresponding element in Ornithorhynchus (Pl. III, fig. 8), is burred in the same manner at its proximal extremity. The present piece is, however, longer than the bone of Ornithorhynchus, and has much more the usual character of a metatarsal. It is not perforate at the base, and has only the usual medullary cavity. It is flat on one side, and convex on the other. It must, however, be regarded as probable that from a more or less normal metatarsal, the basal bone of the spur of Ornithorhynchus has been derived; the spur proper representing one or more phalanges.

That the posterior foot of Vertebrata includes six toes is maintained by Baur. This is confirmed by the presence of a digit within the hallux in various Batrachia Anura. In *Rana catesbeiana* this digit has three segments, a metatarsal and two phalanges, the former resting directly on the astragalus. This digit appears to have been present in the Clepsydropidæ.

EXPLANATION OF PLATES.

PLATE II.

Figs. 1–2. *Naosaurus claviger* Cope. From the Permian formation of Texas.

Fig. 1. Posterior part of skull, left side; one-half natural size. Restored from skulls of *N. cruciger* and *Dimetrodon incisivus*. *Pa*, Parietal bone; *J*, jugal; *QJ*, Quadratojugal; *Opo*, Opisthotic; *Sq*, Squamosal; *Q*, Quadrate; *Pt*, Pterygoid.

Fig. 2. Part of palatopterygoid arch of the same from below; three-quarters natural size.

Fig. 3. *Naosaurus microdus*, part of palatopterygoid arch from below; three-quarters natural size.

Figs. 4–5. *Ectocynodon incisivus*, skull; from the Permian formation of Texas; natural size.

Fig. 4. From above.

Fig. 5. From below.

PLATE III.

Figs. 1–2. *Naosaurus claviger*, dorsal vertebræ; one-half natural size.

Fig. 1. Front view.

Fig. 2. Right side.

Fig. 3. *Naosaurus cruciger*, neural arch and spine, from front; one-half natural size; centrum in outline.

Fig. 4. *Naosaurus microdus*, distal view of distal end of neural spine; three-fourths natural size.

Fig. 5. *Dimetrodon?* sp., sternum, inferior face.

Fig. 6. *Theropleura* sp. ?, part of posterior foot; three-fourths natural size. *As*, Astragalus; *Ca*, Calcaneum; *Na*, Navicular; *Cu*, Cuboid; *Ecc*, Ectocuneïform; *M*, Mesocuneïform; *Enc*, Entocuneïform; phalanges partly restored.

Fig. 6a. Calcaneum, anterior view.

Fig. 7. Supposed first metatarsal of Pelycosaurian, twice natural size; 7 and 7*a*, opposite lateral views; *b*, proximal end.

Fig. 8. *Ornithorhynchus anatinus*, internal digit or spur, from Owen, Anatomy of Vertebrata, ii, fig. 199; *a*, metatarsal; *b*, phalange; *c*, metatarsal, proximal view.

ARTICLE V.

SYNOPSIS OF THE VERTEBRATE FAUNA OF THE PUERCO SERIES.

BY E. D. COPE.

Read before the American Philosophical Society, January 20, 1888.

The Puerco formation rests on the Laramie in Northwestern New Mexico and Southwestern Colorado, and is largely covered by the Wasatch Eocene in both regions. It was discovered by the writer in 1874 at its eastern outcrop of about 500 feet thickness, and was identified by Endlich and Holmes in Colorado in 1876, where the thickness reaches 1000 to 1200 feet. On the San Juan river its thickness is 700 feet, while at its western outcrop south of that river, its thickness is 800 or 900 feet. While the formation possesses lithological peculiarities, no clue to its importance in geologic chronology was known until the discovery of vertebrate remains was made in 1880, by Mr. David Baldwin. With the evidence derived from this material, the writer has been able to interject into the series of epochs of geological time a period which must have possessed many peculiarities, and which differed in such important essentials from those which preceded and from those that followed it, that an immense interval between them is proven to have existed, such as had not been previously suspected. The rich fauna which it contains displays characters which indicate other discoveries yet to be made before connections with other epochs both prior and subsequent can be known.

The vertebrate fauna includes up to the present date one hundred and six known species. Four species of Mollusca have been discovered, which have been determined by Dr. C. A. White of the U. S. National Museum. They are *Unio rectoides* White; *Helix adipis* White; *H. nacimientensis* White, and *Pupa leidyi* Meek. The first named is found in the Wasatch, and the last in the ? Bridger; the two other species are peculiar. Besides these the only other indication of organic life at that period is petrified wood of undetermined trees, which is quite abundant.

The character of the vertebrate fauna is indicated by the following table:

Reptilia			12
Crocodilia		3	
Testudinata		5	
Rhynchocephalia		3	
Ophidia		1	
Aves			1
Mammalia			93
? Marsupialia		11	
Bunotheria		52	
Tæniodonta	3		
Creodonta	49		
Taxeopoda		28	
Quadrumana	?4		
Condylarthra	24		
Amblypoda		2	
Total			106

In 1874 the writer advanced the proposition that the ancestors of modern placental Mammalia would be found to be "plantigrade pentadactyle bunodonts." This anticipation was partly realized in the fauna of the Wasatch epoch subsequently discovered, but is completely so in the characters of the Mammalia of the Puerco epoch. All the placentals, and probably the implacentals also, were "plantigrade pentadactyle bunodonts." More than this the placentals nearly all present the primitive type of dentition of the maxillary series, since the superior molars are nearly all of the tritubercular type. But four species out of the eighty-two placentals are quadritubercular. In the inferior molars the tuberculo-sectorial, or quinquetubercular type of dentition, is extensively prevalent, but not so generally so as the superior tritubercular. Thus of the eighty-two placentals sixty-four present the primitive type.

In its relations to other faunæ, the Puerco is totally distinct as to species. No determined species came to it from an earlier epoch, and none continued after it. Of genera not widely distributed in time, one of lizard-like Rhynchocephalia, Champsosaurus, comes over from the Laramie, with a genus of tortoises, Compsemys. Another genus of tortoises, Chelydra, probably commences at this epoch, to continue through the European Miocenes to the present time, since it still exists in North America. Among Mammalia, two genera only continue later. Didymictis is found in the Wasatch and Bridger formations, and Chriacus in the Wasatch. Not only this, but the entire family of the Periptychidæ ceased at the close of the Puerco. The same is true of the Amblypod family Pantolambdidæ. One of the most important features of the fauna is, however, the presence of eleven species of the ? Marsu-

pialia Multituberculata, a suborder which commenced in the Triassic age, and which terminated its existence so far as the Northern hemisphere is concerned with the end of the Puerco epoch. This series of animals gives a Mesozoic character to the fauna, which is not necessarily counterbalanced by the characters of the remaining types. The placentals are in all probability those which existed during the latter part of Mesozoic time, and the absence of some of the forms of the Eocene increases the weight of the impression thus produced. Thus two orders universally present in the Eocenes, the Perissodactyla and the Rodentia, are wanting from the Puerco.

In conclusion it may be safely asserted that in the Puerco fauna we find the ancestors of the species of Eocene and of later times. In the Tæniodonta we get ancestors of Tillodonta and probably of Rodentia and Edentata. In Creodonta we get the ancestors of the Carnivora, in the family of the Miacidæ. In the Condylarthra we get the ancestors of the Diplarthra and Amblypoda, and in the Puerco Amblypoda the ancestors of those of the following epochs. Hence the investigation of this fauna possesses an especial interest for the mammalogist and for the evolutionist, as well as for the geologist proper.

I give first a list of the species, and then give descriptions of new species, with the osteology of such as the material permits.

In describing the dentition I have, after consultation with my friend Professor W. B. Scott, of Princeton, followed the method of enumeration of premolar teeth introduced by Kowalevsky, and adopted by Schlosser. In this method the premolar teeth are counted from behind forwards, so that the one usually enumerated as number four becomes number one, and *vice versa*.

The only catalogue of the Vertebrata of the Puerco which has appeared was published in the Proceedings of the American Philosophical Society for 1882, beginning at page 461. Since that time the following publications relating to that fauna have appeared:

First Addition to the Fauna of the Puerco Eocene. By E. D. Cope, loc. cit., 1883, Jan., p. 545.
Second Addition to the Knowledge of the Fauna of the Puerco Epoch, loc. cit., 1883, Dec., p. 309.
On Some Fossils of the Puerco Formation. Proc. Acad. Nat. Sci. Phila., 1883, p. 168.
The Tertiary Vertebrata of the West. Report U. S. Geol. Surv. Terrs., F. V. Hayden, Vol. III, Feb., 1885.
On Some New Tæniodonta of the Puerco. Amer. Naturalist, 1887, p. 469.
The Marsupial Genus Chirox, loc. cit., 1887, p. 566.

The present enumeration brings together all the species hitherto described, and adds a number of new ones. The whole number, it will be observed, reaches 106, which are referred to thirty-four genera.

Information at present available indicates that there is some faunal difference

between the lower and upper beds of the formation. I give a list of species which have been found in the lower part of the formation only, and leave for future research to determine whether they occur in the upper part of the formation or not:

MARSUPIALIA.	*Neoplagiaulax americanus.*
	Polymastodon taöensis.
	" *attenuatus.*
	" *latimolis.*
CREODONTA.	*Hemiganus otariidens.*
	Onychodectes tisonensis.
	Mioclænus pentacus.
	" *bathygnathus.*
	" *crassicuspis.*
	" *coryphæus.*
	" *gaudrianus.*
	" *filholianus.*
	" *turgidunculus.*
	Chriacus priscus.
	" *hyattianus.*
	" *ruetimeieranus*
	Triisodon biculminatus.
CONDYLARTHRA.	*Periptychus brabensis.*
	" *coarctatus.*
	Ectoconus ditrigonus.

All but one of the species of Mioclænus belong to the section Sarcothraustes, which has five cusps on the inferior true molars.

REPTILIA.

CROCODILIA.

Crocodilus sp.
Crocodilus sp.
Crocodilus sp.

TESTUDINATA.

Plastomenus ? communis Cope.
Chelydra crassa Cope, sp. nov. infra.
Compsemys sp.
Emys sp.
Trionyx sp.

RHYNCHOCEPHALIA.

Champsosaurus australis Cope; Amer. Naturalist, 1881, p. 690; Tertiary Vertebrata, p. 107, Pl. XXIII b, figs. 1–4.
Champsosaurus puercensis Cope; Proc. Amer. Phil. Soc., 1881, p. 195; Tertiary Vertebrata, p. 107, Pl. XXIII b, figs. 5–10.
Champsosaurus saponensis Cope; loc. cit., 1881, p. 196, p. 109, Pl. XXIII b, figs. 11–22.

OPHIDIA.

Helagras prisciformis Cope; Proc. Amer. Phil. Soc., 1883, p. 545; Tertiary Vertebrata, 1885, p. 731, Pl. XXIV g, fig. 2. Several individuals.

AVES.

Fragments of bones of a few undetermined species of birds have been found.

MAMMALIA.

? MARSUPIALIA.

It has been recently discovered that the genus Ornithorhynchus possesses, in an early stage, molar teeth exceedingly similar to those of the genus Ptilodus. I suspect for this reason, that the Multituberculata belong to the Monotremata rather than to the Marsupialia. This fact, if demonstrated, will account for the taxonomic isolation of this group from the known Marsupialia, though some Monotreme has probably given origin to the latter. (See Amer. Naturalist, Feb., 1888.)

Multituberculata.

Ptilodus mediævus Cope; Amer. Naturalist, 1881, p. 922; Tertiary Vertebrata, p. 173, Pl. XXIII d, fig. 1. Five individuals.

Ptilodus trovessartianus Cope; loc. cit., 1882, p. 686; Tertiary Vertebrata, p. 737, Pl. XXV f, fig. 19. Two individuals.

Additional and much more perfect specimens of the lower jaws of this species confirm its characters as originally defined.

Neoplagiaulax americanus Cope; Amer. Naturalist, 1885, p. 493. One individual.

Neoplagiaulax molestus Cope; loc. cit., 1886, p. 451, et infra. Two individuals.

Chirox plicatus Cope; Proc. Amer. Phil. Soc., 1883, p. 321; Amer. Naturalist, 1887, p. 566, fig. Two individuals.

Polymastodon latimolis Cope; Amer. Naturalist, 1885, p. 385. One individual.

Polymastodon taöensis Cope; loc. cit., 1882, p. 684; 1884, p. 688, figs. 3–4; Tertiary Vertebrata, p. 732, Pl. XXIII c, figs. 1–6. *Tæniolabis scalper*, Amer. Naturalist, 1882, July; Tertiary Vertebrata, p. 193, Pl. XXIII e, fig. 7. *Catopsalis pollux* Cope; Amer. Naturalist, 1882, p. 685; Tertiary Vertebrata, 1885, p. 734, Pl. XXIII c, figs. 1–5. Twenty individuals.

Polymastodon attenuatus Cope; Amer. Naturalist, 1885, p. 494. One individual.

Polymastodon fissidens Cope; Amer. Naturalist, 1884, p. 688. *Catopsalis fissidens* Cope; Proc. Amer. Phil. Soc., 1883, p. 322. One individual.

Polymastodon foliatus Cope; Amer. Naturalist, 1884, p. 688, fig. 5. *Catopsalis foliatus* Cope; loc. cit., 1882, p. 416; Tertiary Vertebrata, 1885, p. 171, Pl. XXIII d, fig. 2. One individual.

BUNOTHERIA.

Tæniodonta.

Psittacotherium aspasiæ Cope; Proc. Amer. Phil. Soc., 1882, p. 192; Tertiary Vertebrata, p. 196, Pl. XXIV c, figs. 3–4. Two individuals.

Psittacotherium multifragum Cope; Amer. Naturalist, 1882, p. 156; Proc. Amer. Phil. Soc., 1881, p. 191; Tertiary Vertebrata, p. 196, Pl. XXIV c, fig. 2; Amer. Naturalist, 1888, p. 5, fig. 1. Three individuals.

Psittacotherium megalodus Cope; Amer. Naturalist, 1887, p. 469. One specimen.

Creodonta.

Hemiganus vultuosus Cope ; Amer. Naturalist, 1882, p. 831 ; Tertiary Vertebrata, 1885, Pl. XXIII c. Four specimens.

Hemiganus otariidens Cope ; Amer. Naturalist, 1885, p. 492 ; et infra. One specimen.

Conoryctes comma Cope ; Proc. Amer. Phil. Soc., 1881, p. 486 ; Tertiary Vertebrata, 1885, p. 198, Pl. XXIII e, figs. 1–5 ; XXV c, figs. 3–4. *Hexodon molestus* Cope ; Amer. Naturalist, 1884, p. 795, fig. 3. Seven individuals.

Onychodectes tisonensis Cope, gen. et sp. nov. infra. Three individuals.

Mioclænus antiquus Cope. *Sarcothraustes antiquus* Cope ; Proc. Amer. Phil. Soc., 1881(2), p. 193 ; Tertiary Vertebrata, 1885, p. 347, Pl. XXIV d, figs. 19–22. One specimen.

Mioclænus conidens Cope. *Triïsodon conidens* Cope ; Proc. Acad. Phila., 1882, p. 297 ; Tertiary Vertebrata, 1885, p. 274, Pl. XXIII d, figs. 9–10. *Diacodon conidens ;* Amer. Naturalist, 1884, p. 350. Three specimens.

Mioclænus bathygnathus Cope, sp. nov. infra. One specimen.

Mioclænus crassicuspis Cope. *Conoryctes crassicuspis* Cope ; Tertiary Vertebrata, p. 201, 1885, Pl. XXXIII e, fig. 6. Three specimens.

Mioclænus coryphæus Cope. *Sarcothraustes coryphæus* Cope ; Amer. Naturalist, 1885, p. 386. Nine specimens.

Mioclænus pentacus Cope, sp. nov. infra. Seven individuals, from the Lower Puerco.

Mioclænus gaudrianus Cope, sp. nov. infra. One specimen.

Mioclænus lydekkerianus Cope, sp. nov. infra. Three specimens.

Mioclænus filholianus Cope, sp. nov. infra. Four specimens.

Mioclænus interruptus Cope. *Deltatherium interruptum* Cope ; Proc. Amer. Phil. Soc., 1882, p. 463 ; Tertiary Vertebrata, 1885, p. 282, Pl. XXIII d, fig. 13. One specimen.

Mioclænus acolytus Cope. *Hyopsodus acolytus* Cope ; Proc. Amer. Phil. Soc., 1882, p. 462 ; Tertiary Vertebrata, 1885, p. 238, Pl. XXXIII d, figs. 5–6. Five specimens.

Mioclænus assurgens Cope. *Triïsodon assurgens ;* Proc. Amer. Phil. Soc., 1883, p. 311. Two specimens.

Mioclænus levisanus Cope. *Triïsodon levisanus* Cope ; Proc. Amer. Phil. Soc., 1883, p. 446 ; Tertiary Vertebrata 1885, p. 273, Pl. XXIV f, fig. 3. Six specimens.

Mioclænus heilprinianus Cope. *Triïsodon heilprinianus* Cope ; Proc. Amer. Phil. Soc., 1886, p. 193 ; Tertiary Vertebrata, 1885, p. 273, Pl. XXIII d, fig. 11. One specimen.

Mioclænus rusticus Cope. *Triïsodon rusticus* Cope ; Proc. Amer. Phil. Soc., 1882, p. 360. One specimen.

Mioclænus subtrigonus Cope ; Proc. Amer. Phil. Soc., 1881, p. 491 ; 1883, p. 555 ; Tertiary Vertebrata, 1885, p. 338, Pl. LVII f, fig. 5, LIV f, fig. 4. Seventeen specimens.

Mioclænus cuspidatus Cope ; Proc. Amer. Phil. Soc., 1883, p. 312. One specimen.

Mioclænus protogonioïdes Cope ; Amer. Naturalist, 1882, p. 833 ; Tertiary Vertebrata, 1885, p. 340, Pl. XXV f, fig. 17. Four specimens.

Mioclænus floverianus Cope, sp. nov. infra. One specimen.

Mioclænus corrugatus Cope, Proc. Amer. Phil. Soc., 1883, p. 560 ; Tertiary Vertebrata, 1885, p. 341, Pl. XXIV f, fig. 5 ; XXIV g, fig. 8 bc ("M. ferox"). Six specimens.

Mioclænus ferox Cope ; Proc. Amer. Phil. Soc., 1883, p. 547 ; Tertiary Vertebrata, 1885, p. 328, Pl. XXIV f, fig. 6 et seq. Four specimens.

Mioclænus opisthacus Cope ; Amer. Naturalist, 1882, p. 833 ; Proc. Amer. Phil. Soc., 1883, p. 312. *Hemithlæus opisthacus* Cope ; Tertiary Vertebrata, 1885, p. 407, Pl. XXV f, figs. 8–9. Twelve specimens.

Mioclænus turgidus Cope ; Amer. Naturalist, 1881, p. 489 ; loc. cit., 1881, p. 830 ; Tertiary Vertebrata, 1885, p. 325, Pl. LVII f, fig. 3–4 ; XXV e, figs. 19–20. Twenty-five specimens.

Mioclænus zittelianus Cope, sp. nov. infra. One specimen.

Mioclænus turgidunculus Cope, sp. nov. infra. Three specimens.

Mioclænus minimus Cope, Proc. Amer. Phil. Soc., 1882, 468 ; Tertiary Vertebrata, 1885, p. 327, Pl. XXV e, figs. 22–4. Five specimens.

Tricentes bucculentus Cope ; Proc. Amer. Phil. Soc., 1883, p. 316. *Mioclænus bucculentus* Cope ; Proc. Amer. Phil. Soc., 1883, p. 555 ; Tertiary Vertebrata, 1885, p. 341, Pl. XXIV g, fig. 2. Three specimens.

Tricentes crassicollidens Cope; Proc. Amer. Phil. Soc., 1883, p. 315. One specimen.

Tricentes inæquidens Cope; loc. cit., 1883, p. 317. Two specimens.

Chriacus truncatus Cope; Proc. Amer. Phil. Soc., 1883, p. 313. Six specimens.

Chriacus pelvidens Cope; Proc. Amer. Phil. Soc., 1883, p. 314; Tertiary Vertebrata, 1885, p. 740. *Lipodectes pelvidens* Cope; Amer. Naturalist, 1881, p. 1019. *Pelycodus pelvidens* Cope; Tertiary Vertebrata, 1885, p. 225, Pl. XXIII d, figs. 7–8. Six specimens.

Chriacus simplex Cope; Proc. Amer. Philos. Soc., 1883, p. 314. One specimen.

Chriacus priscus Cope, sp. nov. infra. Six specimens; Lower Puerco.

Chriacus schlosserianus Cope, sp. nov. infra. Four specimens; Upper Puerco.

Chriacus baldwini Cope. *Deltatherium baldwini;* Proc. Amer. Phil. Soc., 1882, p. 463; Tertiary Vertebrata, 1885, p. 282, Pl. XXIII d, fig. 12. Three specimens.

Chriacus hyattianus Cope; Amer. Naturalist, 1885, p. 385. *Loxolophus adapinus* Cope; loc. cit., p. 386. Four specimens; Lower Puerco.

Chriacus ruetimeyeranus Cope, sp. nov. infra. One specimen.

Chriacus stenops Cope, sp. nov. infra. Three specimens; Upper Puerco.

Chriacus inversus Cope, sp. nov. infra. One specimen.

Deltatherium fundaminis Cope; Amer. Naturalist, 1880, p. 338; Tertiary Vertebrata, 1885, p. 278, Pl. XXIII e, figs. 8–11; XXV a, fig. 10; XXV d, fig. 3. *Lipodectes penetrans* Cope; Amer. Naturalist, 1881, p. 1019. Twenty-three specimens.

Triïsodon biculminatus Cope, sp. nov. infra. Two specimens; Lower Puerco.

Triïsodon quivirensis Cope; Amer. Naturalist, 1881, p. 667; Tertiary Vertebrata, 1885, p. 270; Pl. XXV c, fig. 2. One specimen.

Dissacus navajovius Cope; Amer. Naturalist, 1881, p. 1019; Tertiary Vertebrata, West, 1885, p. 344, 741. Eight individuals.

Dissacus carnifex Cope; Amer. Naturalist, 1882, p. 834; Tertiary Vertebrata, 1885, p. 345, Pl. XXIV g, figs. 3–4. One individual.

Didymictis haydenianus Cope; Proc. Amer. Phil. Soc., 1882, p. 464; Tertiary Vertebrata, 1885, p. 306; Pl. XXIII e, figs. 12–13. Three specimens.

Didymictis primus Cope; Proc. Amer. Phil. Soc., 1883, p. 309. Three specimens.

? Lemuroidea.

Mixodectes pungens Cope; Proc. Amer. Phil. Soc., 1883, p. 447; Tertiary Vertebrata, 1885, p. 241, Pl. XXIV f, fig. 1. Two specimens.

Mixodectes crassiusculus Cope; Proc. Amer. Phil. Soc., 1883, p. 447; Tertiary Vertebrata, 1885, p. 242, Pl. XXIV f, fig. 2. Three individuals.

Indrodon malaris Cope; Proc. Amer. Phil. Soc., 1883, p. 318. One specimen.

CONDYLARTHRA.

Haploconus corniculatus Cope, sp. nov. infra. Six specimens.

Haploconus lineatus Cope; Amer. Naturalist, 1882, p. 417; Tertiary Vertebrata, 1885, p. 417, Pl. XXV e, fig. 1–4. Twenty-four specimens.

Haploconus angustus Cope; Tertiary Vertebrata, 1885, p. 416, Pl. LVII f, fig. 6. *Mioclænus angustus* Cope; Amer. Naturalist, 1881, p. 831. Two specimens.

Haploconus xiphodon Cope; Proc. Amer. Phil. Soc., 1882, p. 466; Tertiary Vertebrata, 1885, p. 420, Pl. XXV e, figs. 5–6. Two specimens.

Haploconus entoconus Cope; Amer. Naturalist, 1882, p. 686; Tertiary Vertebrata, 1885, p. 421, Pl. XXV f, figs. 4–5.

Haploconus cophater Cope. *Anisonchus cophater;* Proc. Amer. Phil. Soc., 1882, p. 321. Three specimens.

Anisonchus mandibularis Cope. *Mioclænus mandibularis* Cope; Amer. Naturalist, 1881, p. 831; Tertiary Vertebrata, 1885, p. 339, Pl. LVII f, fig. 7. Two specimens.

Anisonchus sectorius Cope; Proc. Amer. Phil. Soc., 1881, p. 488; Tertiary Vertebrata, 1885, p. 413, Pl. XXV c, figs. 5–6 and 8. *Mioclænus sectorius* Cope; Amer. Naturalist, 1881, p. 831. Thirteen individuals.

Anisonchus coniferus Cope; Amer. Naturalist, 1882, p. 833; 1884, p. 803, fig. 12 c; Tertiary Vertebrata, 1885, p. 409. Four specimens.

Anisonchus gillianus Cope; Proc. Amer. Phil. Soc., 1882, p. 467; Tertiary Vertebrata, 1885, p. 411, Pl. XXV f, figs. 10–11. *Haploconus gillianus* Cope; Amer. Naturalist, 1882, p. 686. Eight individuals.

Anisonchus agapetillus Cope; Proc. Amer. Phil. Soc., 1883, p. 320. Six specimens.

Zetodon gracilis Cope; Tertiary Vertebrata, Pl. XXIX d, explanation, and fig. 9. Two individuals.

Hemithlæus apiculatus Cope. *Anisonchus apiculatus* Cope; Tertiary Vertebrata, Pl. XXV e, fig. 7. Eight individuals.

Hemithlæus kowalevskianus Cope; Amer. Naturalist, 1882, p. 833; Tertiary Vertebrata, 1885, p. 405, Pl. XXV f, figs. 6–7. Sixteen specimens.

Periptychus brabensis Cope, sp. nov. infra. Fourteen individuals; the Lower Puerco.

Periptychus coarctatus Cope; Tertiary Vertebrata, Pl. XXIX d, explanation and figs. 7–8. Five individuals; from the Lower Puerco.

Periptychus carinidens Cope; Amer. Naturalist, 1881, p. 337; Proc. Amer. Phil. Soc., 1881, p. 484; Tertiary Vertebrata, 1885, p. 403, Pl. XXV a, fig. 16; XXIII d, figs. 14–15; XXIV g, fig. 5. Five specimens.

Periptychus rhabdodon Cope; Tertiary Vertebrata, 1885, p. 391, Pl. XXIII f, XXIII g, figs. 1-11; LVII, figs. 1–2; Amer. Naturalist, 1884, p. 801, figs. 1–2 and 6–9. *Catathlæus rhabdodon* Cope; Amer. Naturalist, 1881, p. 830; Proc. Amer. Phil. Soc., 1881, p. 487. One hundred and thirty-eight individuals; from the Upper Puerco.

Ectoconus ditrigonus Cope; Amer. Naturalist, 1884, p. 796, figs. 4–5. *Periptychus ditrigonus* Cope; Tertiary Vertebrata, 1885, p. 404, Pl. XXIII g, fig. 12; XXIX d, figs. 2–6. Thirty-two individuals; from the Lower Puerco.

Protogonia zuniensis Cope. *Phenacodus zuniensis* Cope; Proc. Amer. Phil. Soc., 1881, p. 492; Tertiary Vertebrata, 1885, 491, Pl. LVII f, fig. 10. Three individuals.

Protogonia calceolata Cope. *Phenacodus calceolatus;* Proc. Amer. Phil. Soc., 1883, p. 559; Tertiary Vertebrata, 1885, p. 487. One individual.

Protogonia plicifera Cope; Amer. Naturalist, 1882, p. 833; Tertiary Vertebrata, 1885, p. 424, Pl. XXV f, figs. 2–3. Eight individuals.

Protogonia puercensis Cope. *Phenacodus puercensis* Cope; Proc. Amer. Phil. Soc., 1881, p. 492; Tertiary Vertebrata, 1885, p. 488, Pl. XXV e, figs. 12–13; LVII f, figs. 8–9. *Protogonia subquadrata* Cope; Proc. Amer. Phil. Soc. 1881, p. 492; Tertiary Vertebrata, 1885, p. 426, Pl. LVII f, figs. 11–12. Twenty-five individuals.

AMBLYPODA.

Pantolambda bathmodon Cope; Amer. Naturalist, 1882, p. 418; Proc. Amer. Phil. Soc., 1883, p. 558; Tertiary Vertebrata, 1885, p. 601, Pl. XXIX b, XXIX c. Seven individuals.

Pantolambda cavirictus Cope; Tertiary Mammalia, Pl. XXIX d, explanation and fig. 1. Four individuals.

DESCRIPTIONS OF SPECIES.

TESTUDINATA.

CHELYDRA Schw.

Char. gen.—Marginal bones of the bridge united with the costals by simple gomphosis, and with the plastron by compound gomphosis. Bridge of plastron nar-

row, with an intermarginal series of scuta, and without fontanelle. Surfaces not sculptured.

CHELYDRA CRASSA sp. nov. *Dermatemys sp.* Cope; Proc. Amer. Phil. Soc., 1882, p. 461.

This species is represented in my collection by fragments of two individuals. Of the typical specimen there are preserved, two vertebral, nine marginal, and three plastral bones; of the second, three vertebral bones. The specimens indicate an animal of the average size of the existing snapping turtle, *Chelydra serpentina.*

The bones of both carapace and plastron are relatively much thicker than the corresponding parts of the snapping tortoise, equaling in this respect the largest existing species of Emys. The bridge of the plastron is not so slender as in *C. serpentina.* The vertebral bones have a median keel-like angle, which becomes at the anterior part of each vertebral scutum a prominent rib. This results from the abrupt depression of the surface on each side immediately posterior to the transverse dermal suture. In the larger specimen this suture is deeply notched anteriorly, and its anterior border is so prominent posteriorly as to give an imbricate appearance, the anterior vertebral scute rolling over the posterior by an obtuse border. The marginals of the bridge are very massive, and the pit for the process of the costal is at one side of the middle, and is nearly round. It is flat in the *C. serpentina.* The pits for the plastral fingers are three, on the inner inferior edge of each marginal, and are directed obliquely. The external face of the marginals is distinguished by a rabbet, the inferior margin of which projects as a ridge beyond the external face. Inferior face convex. No other except the fine mutual sutures on the marginals of the bridge. The free marginals, of which I have two, and one of them the anal, have no gomphosis nor suture with the costals or pygal, being held in place by the integuments and by the mutual marginal sutures. The dermal scuta are well marked, the marginals having their bounding suture below that of the marginal bones. Surface of the shell everywhere smooth.

Measurements.

No. 1.			*Inch.*
Anteroposterior diameter of vertebral bone			.8
Diameters of marginal of bridge	anteroposterior		.83
	transverse (greatest)		.35
	vertical		.98
Diameters of anal marginal	anteroposterior		.13
	vertical		.35
	transverse		.43
Diameters of hyosternal	anteroposterior	interiorly	1.00
		medially	.43
	transverse (without gomphosis)		1.90
	vertical (at middle)		.23

Measurements.

	No. 2.	*Inch.*
Diameters of vertebral bone	anteroposterior	1.13
	transverse	1.20
	vertical	.40

This is the oldest species which can be referred to this genus.

? MARSUPIALIA.

All of the Puerco implacentals belong to the suborder Multituberculata, and to three families, which are defined as follows:*

Premolars present, compressed and trenchant in form ..... *Plagiaulacidæ.*
Premolars present, molariform, different from true molars in form ..... *Chirogidæ.*
Premolars wanting or rudimental ..... *Polymastodontidæ.*

To the first belong, in the Puerco fauna, Ptilodus and Neoplagiaulax; to the second, Chirox; and to the third, Polymastodon.

NEOPLAGIAULAX Lemoine.

Bulletin of the Geological Society of France, 1881, November.

I have referred the American species of Plagiaulacidæ with but one, the first inferior premolar, to the above genus. Those with two premolars I have referred to Ptilodus (October, 1881).

NEOPLAGIAULAX MOLESTUS Cope; Amer. Naturalist, 1886, p. 451.

This species was established on a separate first inferior premolar. I now describe a mandibular ramus which probably belongs to it. It has suffered the loss of the crown of the molar, and the greater part of that of the premolar teeth. The latter has its base oblique in both the vertical and horizontal directions; its posterior base rounded. True molars small, and on the inner side of the coronoid process. Incisor one, rodent-like. Angular inflection of the mandible well developed, but the posterior border has been broken away. Its form is robust, especially at the external base of the large premolar tooth, where a longitudinal swelling rises posteriorly, and disappears in the base of the coronoid process. Below and posterior to this protuberance the masseter fossa extends, having an oblique boundary below in the externo-superior face of the external inflection of the base of the ramus. The internal inflection commences more posteriorly, and projects inwards at a right angle to the vertical plane. Anterior to these inflections the inferior outline of the ramus is gently convex downwards in conformity to the arc required by the alveolus of the large

* Amer. Naturalist, 1884, p. 687; 1887, p. 567.

inferior incisor. The latter issues from the jaw at a considerable distance in advance of the first premolar, leaving a wide diastema, which has a rather wide and obtuse superior surface. The alveoli of the true molar are within the base of the coronoid process, and indicate a tooth of much smaller size than the premolar. The symphysis is short, and is indicated almost exclusively by rugosities of the inferior and anterior border of the extremity of the ramus. The articulation has been a loose one by ligament.

Measurements.	*M.*
Length of fragment of ramus	.057
" " diastema	.013
Diameters p. m. i anteroposterior	.013
Diameters p. m. i transverse posteriorly	.005
Length of base of m. i (estimated)	.006
Depth ramus at diastema	.016
" " " posterior base of p. m. i	.021
Diameters of incisor vertical	.007
Diameters of incisor transverse	.004

The tooth from which the species was originally characterized has the following characters: Length of base one-third greater than in *Neoplagiaulax americanus*, and there are fifteen keel-crests on the side of the crown, while there are but seven in the *N. americanus*. The outline of the crown is elongate and moderately convex, and less elevated than in the known species of Ptilodus. The irregularity in the outline of the base of the crown is less than in the other species, and the diameter of the roots is subequal. The anterior base of the crown is not excavated for the second premolar as in Ptilodus. Length of base of crown, 16 mm.; elevation at middle, 8 mm.

In size this species is about equal to the *Polymastodon foliatus*.

CREODONTA.

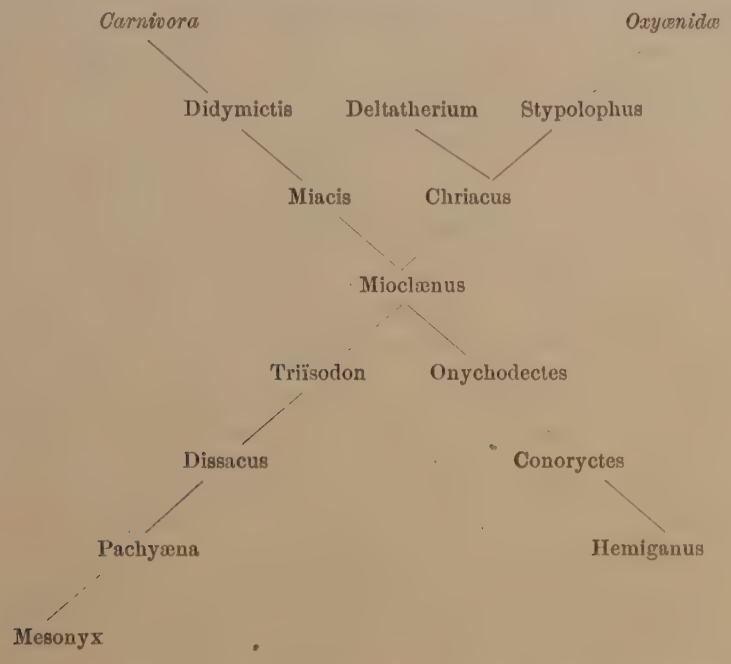
Important additions to the knowledge of this suborder have been made recently by Professor W. B. Scott* and Dr. Max Schlosser.† The former has determined the presence of the subcylindric postzygapophyses in Didymictis, and I have ascertained their existence in Esthonyx and Dissacus. Scott shows that in Hyænodon the characters of the carpus and of the brain coincide with those of this group. He also finds an os centrale in that genus and in Mesonyx, and Osborn has found it in Esthonyx.

In the following pages considerable additions to the general osteology of Hemi-

* On Some New and Little-known Creodonta; Jour. Acad. Phil., 1886, p. 155.

† Die Affen, Lemuren, Chiropteren, Insectivoren, Marsupialia, Creodonten und Carnivoren des Europäischen Tertiärs; Wien, 1887. Alfred Hölder.

ganus, Onychodectes, Mioclænus, Chriacus and Dissacus are made, and they throw considerable light on the phylogeny of the various genera. It is apparent on all grounds that Mioclænus is the central type of Creodonta for the Puerco Epoch, and that all other types of the suborder may be traced to it as derivative, either by progressive or retrogressive specialization. Thus the line which our present knowledge ends with Hemiganus, is one of simplification and reduction of the molar dentition at the expense of increase in the development of the canine dentition, as takes place in the line of the seals. In the line of the Mesonychidæ another kind of simplification of the molar dentition of the inferior series appears, and the feet undergo specialization, apparently in accordance with the needs of a terrestrial life. A third line leading towards the Oxyænidæ commences with the genus Chriacus, which is easily modified into Stypolophus on the one hand and Deltatherium on the other, the latter having some special characters of its own, and forming probably the end of its line. The line which gives us Miacidæ, and in Miocene times the Carnivora, probably diverged from a Mioclænus, but from a species of an earlier horizon than the Puerco, since two species of Didymictis are already contemporaries with the Mioclænus of that age. These relations may be displayed as follows :



In the reference of these genera to families, lack of information as to certain parts of the structure forbids final conclusions. Leaving aside the Miacidæ and Oxyænidæ, we find that the Proviverridæ (Schlosser, Leptictidæ, Div. II, Cope) em-

braces Deltatherium, Mioclænus, and probably Triïsodon and Onychodectes, of the Puerco genera. Dissacus is on the boundaries of the Mesonychidæ, but the ungues are unknown, and the astragalus is not trochlear. That Hemiganus can be referred to the Proviverridæ is improbable. The characters of a family Hemiganidæ would be: *Superior molars with confluent roots, and tritubercular crowns; inferior molars quadritubercular; astragalus not trochlear; ungues much compressed.* The sole character separating this family from the Proviverridæ is the confluence of the roots of the superior true molars. It is approached in this respect by the genus Conoryctes, which will, however, remain in the Proviverridæ as an aberrant form, connected with Mioclænus by Onychodectes. The tendency of this group is to resemble the Tæniodonta, but whether there is any affinity involved in this resemblance does not yet appear.

The line of the Mesonychidæ shows definite changes in the following respects: First, loss of the internal cusps of the inferior molars. The diminution of these cusps is seen most prominently at first in the genus Triïsodon, and more distinctly in the later *T. quivirensis* than in the earlier *T. biculminatus*. It has progressed far in Dissacus. Second, in the reduction of the number of the digits; the hallux has become very small in Dissacus and is gone in Mesonyx. Third, in the production of a distinct facet for the cuboid bone on the extremity of the astragalus. The contact of the astragalus and cuboid is seen in many if not all Creodonta, but the navicular and cuboid surfaces are not distinguished from each other. In Mesonyx and Pachyæna it is well known that they form distinct facets separated by an angle, as in Perissodactyla. This structure appears in a primitive condition in Dissacus, the angle being obtuse and rounded. It is an excellent illustration of the origin of a zoölogical character. The thoroughly diplarthrous type of the astragalus in Mesonyx is associated with an ungulate form of ungual phalanges, and I suspect that the resemblance is not accidental. The form of the distal end of the diplarthrous astragalus is probably due to impacts combined with energetic flexion and extension. But why the structure should appear in Mesonyx and not in Phenacodus is, as yet, an unanswered question.

Although it is now evident that the Pinniped Carnivora cannot be derived from the genus Mesonyx, as is truly maintained by Scott, it appears to me that they have been derived, like other Carnivora, from some form of Creodonta. The retrograde development of the molar teeth probably passed through stages like those of Dissacus and Hemiganus, and the ungual phalanges might have been easily derived from such as are possessed by Pachyæna.

HEMIGANUS Cope.

Amer. Naturalist, 1882, p. 831 : Tertiary Vertebrata, 1885, Pl. XXIII c, figs. 7–12 ; Amer. Naturalist, 1885, p. 492.

The claws are large and compressed like those of a prehensile-footed carnivore. The astragalo-tibial articulation is nearly flat. The femur is very robust, and has a low third trochanter, as in Bunotheria generally. The vertebræ of the neck are short and wide. The jaws have a very large and wide coronoid process, as in Calamodon, and the horizontal rami are very robust. Only one true molar (the first) is preserved, and it has the crown worn. Its outline is subround, with a notch on the internal side. There are probably but two true molars; they have two roots. There are at least four premolariform teeth, and their crowns are short, obtuse cones, with a low heel-like expansion at the inner side of the posterior base, and have but a single root. They resemble very nearly the teeth of some of the eared seals. There is a robust canine tooth in the upper jaw, which is not separated from the premolars by a diastema. There is at least one superior incisor, but the exact number is unknown. There is a large tooth on each side of the symphysis of the lower jaw, but in the specimens it is not in place. It has enamel on the anterior face only, and its apex is worn transversely. The wear descending passes to one side of the middle line. It evidently has a median position, and may be therefore an incisor. Its form reminds one of that of the second inferior incisor of Calamodon, but the enamel-face is much shorter.

Should the large inferior teeth be canines, the mandibular dentition will greatly resemble that of the seals, as does that of the maxillary bone. The absence of post-orbital angles resembles the condition in the Phocidæ. The wide vertical coronoid process and the flat vertical angle are as in Calamodon. The sagittal crest is elevated, and the brain-case very small.

This genus resembles in several respects the Tæniodonta, and confirms the propriety of the union of that group with the Creodonta into the order Bunotheria.

The typical species, *H. vultuosus*, was an animal of probably the size of a grizzly bear. A second and considerably smaller species is described below.

HEMIGANUS OTARIÏDENS Cope ; Amer. Naturalist, 1885, p. 492. Hujus operis, Plates IV and V.

Only one individual of this species has been found, but it is represented by many parts of the skeleton. It was a plantigrade beast of about the size of a black bear, of robust proportions, and with a wide head with an exceedingly short thick muzzle, armed with some formidable teeth in front. These, with its sharp claws, made it the most formidable animal yet known of the Puerco fauna, excepting its larger and more powerful congener, the *H. vultuosus*.

The nares are well roofed by the nasal bones, which border the premaxillaries

above to the line of the front of the second superior incisor, by a wide sutural surface. The superior process of the premaxillary bone is short, not extending posterior to the vertical line of the posterior face of the superior canine tooth. A small foramen, perhaps the infraorbital, issues above the second tooth posterior to the canine. Exterior to the third tooth that follows the canine, the external face of the maxillary bone spreads outwards as though forming the malar process, and that this is the case is rendered probable by its smooth superior surface, which is the inferior orbital border. Just anterior to the orbital border, a large foramen from the maxillary antrum perforates the maxillary bone. The two teeth in the maxillary bone are injured, but the anterior has a conical crown and a single root, while the crown and base of the second are widened a little transversely. I can find no superior true molars in the collection.

The mandibular rami are remarkable for the shortness of the dentary portion, and the elevation and width of the coronoid process. The condyle is elevated above the alveolar border of the lower jaw, when the inferior border of the ramus is horizontal. The ramus increases in depth anteriorly, as in Tæniodonta, to accommodate the large anterior teeth. The inferior border is straight and compressed, and the posterior border is gently concave to a short rectangular angle, which does not extend posteriorly to the line of the base of the condyle. It is therefore much less prominent than in Creodonta generally, resembling in this respect the Tæniodonta. There are four alveoli for single-rooted molars, and apparently another one in front of the anterior one of the four. This would give seven molars, the first true molar having the form of a premolar; but the distribution of the teeth is not quite certain. As already described, the heel of these premolariform teeth is partly internal. The first true molar may be one of these simple teeth. The second has two roots, and the crown is about as wide as long. The crown consists of an anterior portion, which is slightly elevated above a posterior heel. The superior face of the crown is worn by mastication so that its construction is not evident, but there is no trace of a division between fourth and fifth tubercles, so that I suspect that the latter did not exist. It is not probable that there were well-marked cusps on the heel.

The parietal region of the skull is very much compressed, and the sides slope regularly upwards to the elevated sagittal crest. The temporal ridge is an oblique angular line of the surface, and the frontal region is flat. No other parts of the skull are preserved.

Measurements of Skull.	*M.*
Depth of maxillary bone at p. m. iv	.038
" " nasal " " canine	.031
Length of maxillary bone to orbital border	.045

Measurements of Skull.		*M.*
Diameters of canine	anteroposterior (oblique)	.015
	transverse (oblique)	.012
Lengths of p. m. iii and iv		.016
" " seven inferior molars		.052
Diameters ? first true molar	anteroposterior	.085
	transverse	.072
	vertical	.050
Length of ramus posterior to molars	to condyle	.070
	to angle	.056
Diameters of coronoid	anteroposterior	.054
	vertical	.044
Width of condyle		.017
Depth of ramus at coronoid		.081
" " " " m. iii		.034
" " " " p. m. iv		.042
Vertical depth of sagittal suture		.027

Only cervical vertebræ are preserved. These have small anteroposterior diameter, and their transverse exceeds their vertical diameter. In general they resemble those of Periptychus. The atlas is peculiar in the small anteroposterior diameter of the paradiapapohysis, whose base is perforated by an anteroposterior canal. It sends upwards a vertical keel to opposite the middle of the facet for the axis. The axis has a cylindric and rather slender odontoid process whose superior extremity is obliquely beveled on a curve. Its articular surface is continuous with the large atlantal facets laterally and inferiorly. The longitudinal axis of the cervical centra is oblique to the horizontal, showing that the head was elevated above the body. The floor of the neural canal is pierced by a foramen of considerable size on each side. A posterior (? seventh) cervical has a greater anteroposterior diameter than the two which precede it, and the vertical diameter is relatively greater. The posterior articular face of all three is slightly concave.

Measurements of Vertebræ.		*M.*
Anteroposterior diameter of atlas		.020
Width of axis at atlantal facets		.038
Length of odontoid process		.011
Diameters of centrum cervical ? iii	anteroposterior	.0085
	vertical	.016
	transverse	.026
Diameters of centrum cervical ? v	anteroposterior	.011
	vertical	.015
	transverse	.029
Diameters of centrum cervical ? vii	anteroposterior	.015
	vertical	.016
	transverse	.028

The anterior limb is represented by parts of both ulnæ, part of one radius, and a metacarpal of the pollex. More than half of one ulna is preserved. The olecranon appears to be short and terminating in an acute apex at the basal border; but it may have been broken off. The humeral cotylus is oblique, extending backwards and outwards, and inwards and forwards. The posterior border is elevated into a ridge, which is convex forwards. The anterior marginal ridge is limited to the external part, and it extends outwards, downwards, and then backwards, overhanging the internal face of the ulna. The radial facet is flat, and slopes gently, and not steeply inwards, it is bordered on the outer side by a low ridge, external to which is a longitudinal groove. Both do not extend far distad, and the superior edge of the shaft of the ulna is narrow and convex. The inferior edge is similar except below the humeral cotylus, where it is transversely flattened, the inferior face turning upwards on the inner side posteriorly. The internal side of the shaft of the ulna is concave, and the external side is convex. The head of the radius is a transverse oval, with subequal broadly rounded extremities. The superior border is openly shallowly excavated, while the inferior is obliquely beveled for the ulnar face. A short tuberosity projects longitudinally from the middle of the ulnar facet. A metacarpal, supposed to be that of the pollex, is quite short and robust and has a proximal excavation of the internal side for the trapezium. This concave facet extends half its length. The distal end is a subround convex facet which presents outwards. It has neither median keel nor groove. It indicates a robust digit.

Measurements of Anterior Limb.		*M.*
Length of fragment of ulna		.117
Depth at middle of glenoid surface		.026
Width " " " " "		.027
Depth at coronoid		.032
Depth at middle of shaft		.023
Diameters head of radius	vertical	.017
	transverse	.026
Diameters shaft radius .045 from proximal end	vertical	.012
	transverse	.012
Length of metacarpal of pollex		.020
Diameters distal facet of do.	vertical	.0135
	transverse	.0135

The femur lacks the distal extremity so that it is not possible to determine its exact length. Its proximal portion is robust, and about as large as that of a fully grown pig. That the animal is not fully grown is shown by the fact that the epiphysis of the head is not united, although it is preserved. The projection of the great trochanter is about equal to that of the head, and is robust, and truncate both

proximally and externally, and incloses a considerable trochanteric fossa. The head has a large fossa for the round ligament which is near the neck, from which it is separated by a low border. The little trochanter is quite prominent, and is reverted, but it is not connected with the great trochanter by a ridge. The third trochanter is well developed, and has a wide external surface, whose anterior edge is recurved forwards. Its upper portion overlaps the line of the inferior edge of the little trochanter, being higher up than in Pachyæna. The middle of the shaft is somewhat depressed, and its margins are rounded.

The proximal part of the left tibia, and the distal part of the right, give the characters of that element. The proximal part is laterally crushed. It is evident, however, that the crest is large and obtuse at the apex, and that the spines are low ridges. The externo-posterior border forms a roughened ridge for 35 mm. below the internal femoral surface, and ceases rather abruptly below. At or near the middle the shaft is normally somewhat compressed, and slender. The malleolus is very prominent, and terminates in an apex in its internal plane. The astragalar surface is but little oblique; the fibular articular surface is large.

One of the metatarsals shows that the foot was short, since it is neither the first nor the fifth. Its proximal face is concave in the transverse direction, but nearly straight anteroposteriorly. The arc of the phalangeal face is less than half a circle, and is slightly concave in transverse section. It is divided medially at its inferior fourth by a short, narrow, and low trochlear keel. Inferior border of phalangeal face prominent and openly emarginate. An ungual phalange is preserved, but whether of the anterior or posterior foot I do not know. Its apex is lost. It is strongly compressed, and has a narrowly rounded superior border. The phalangeal cotylus is deeply excavated, and is rather narrow, and has a weak median keel. The superior process overhangs the phalangeal surface rather further than the inferior. The tuberosity for the flexor tendon is a longitudinal oval, with surface transversely convex, which gradually ascends to the narrow but flat inferior surface of what remains of the phalange. The large nutritive foramen enters above its middle.

Measurements of Posterior Limb.		*M.*
Length of femur preserved		.123
Width at head		.061
Length proximad of little trochanter, inclusive		.064
" " " third " "		.085
Diameters shaft of femur	anteroposterior	.019
	transverse	.029
Diameters shaft of tibia	anteroposterior	.023
	transverse	.016

Measurements of Posterior Limb.		*M.*
Diameters distal end of tibia	anteroposterior	.025
	transverse	.030
Length of phalange		.024
Diameters of distal end	anteroposterior	.013
	transverse	.011
Depth of unguis	at tendinous insertion	.019
	anterior to tendinous insertion	.013
Width of unguis	at phalangeal surface	.009
	at tendinous tuberosity	.006
	anterior to tendinous tuberosity	.005

CONORYCTES Cope.

Proc. Amer. Phil. Soc., 1881, p. 486; Tertiary Vertebrata, 1885, p. 198. *Hexodon* Cope; Amer. Naturalist, 1884, p. 794.

Additional material representing the type species of this genus enables me to give the characters more fully than hitherto. The *C. comma* experienced an early obliteration of the details of the structure of the crowns of the molar teeth through the thinness of the enamel layer and the mastication of hard substances, so that they are seen in but few specimens.

The superior true molars, and the first premolar, have two external conical cusps, and an internal triangular table, whose inner angle is produced downwards to a line with the apices of the internal cusps. The inferior premolars and the first premolar have the anterior part much elevated above the posterior. The former consists of a large external and a small internal cusp joined to near their summits, except on the first premolar which has but one anterior cusp, which is simple acute cone. A rudimental fifth cusp is present on the true molars.

The mastication in this genus is affected by a scooping action of the keels of the inferior molars against the internal table of the superior molars by a motion which is partly transverse, as in Onychodectes.

There are probably four inferior premolars in this genus, but the anterior two have but one root each, and are close together. My supposition that some specimens had but three premolars led me to propose the genus Hexodon, which is now abandoned.

The position of the genus is doubtful, owing to the absence of the ungual phalanges. It is probably Creodont rather than Condylarthrous, for two reasons; one is the close resemblance of the dentition to those of Onychodectes and Hemiganus, between which it takes a natural position. The other is, that it displays no resemblance to any of the Condylarthra in the details of its structure.

But one species is known to me.

CONORYCTES COMMA Cope ; loc. cit., *Hexodon molestus* Cope ; loc. cit., fig. 3.

This animal was about the size of a wolverine, of which species one is reminded by its robust characters. It had an elevated sagittal crest and a strong inion. In a series of teeth which are but little worn the following characters may be discerned. The crown of the inferior canine has a flat inner face, beyond which the anterior surface extends inwards, forming a rib-like border. The enamel on the internal and posterior faces extends but a short way from the apex, and is thin, while on the convex anteroexternal face, it extends below the usual position. It thus approaches the condition seen in Hemiganus. A similar state of affairs is seen in the molars, where the enamel is extended much further on the external face of the inferior and the internal face of the superior molars than is usual, approaching the genera mentioned and also the Tæniodonta in this respect. There are no cingula on any of the molars of either series excepting on the external side of the superiors ; and there it sends out a process or cusp between the two external cusps. The crowns of the inferior molars are notched at the junction of the anterior and posterior parts. The notch is the section of a vertical groove from the base of the crown on the external side, and of a very short superficial one of the internal side. The fifth cusp is median, and about opposite the rim of the heel in elevation. The grooves of the first premolar are similar to those of the true molars. There is no anterior basal cusp. The heel is large and has a raised border on the posterior and inner sides, and an external median lateral conic cusp. This when worn joins the curved crest, forming a comma-shaped figure.

A specimen represented by fragments includes a canine characteristic of the genus, but of such relatively smaller size, that I suppose the animal to be a female.

Seven individuals have come under my observation.

ONYCHODECTES Cope, gen. nov.

Superior molars tritubercular, the external cusps distinct ; the internal with the intermediate confounded in a prismatic form with flat grinding surface, and whose internal angle rises claw-like to an elevation equal to that of the external cusps, and without cingula or appendicular cusps. First premolar with but one external and one internal cusps. Inferior molars seven, the true molars with five cusps, the anterior triangle distinct. Last inferior molar with a heel ; canine large.

Caudal vertebræ robust. Ilium rather slender, flat-triangular in section, and with a small anterior-inferior spine. Scapula with coracoid hook, and abruptly rising spine. Astragalus with unequal trochlear ridges, the internal the lower. Internal face oblique, but less so than in the species of Mioclænus where it is known, and not

produced farther posteriorly than the external face, which is vertical. Head depressed, convex, and without angles. Cuboid with a small external distal facet.

This genus is intermediate in character of teeth between Conoryctes and Mioclænus. The molars are those of the former as to the internal portion of the crown. The external cusps are more those of Mioclænus, and there is but one external cusp of the first premolar, while there are two in Conoryctes. It is in the remarkable table-like form of the interior part of the crown and the hoof-like production of the internal angle, that Onychodectes differs from Mioclænus.

But one species is known to me.

ONYCHODECTES TISONENSIS sp. nov.

Two individuals certainly represent this species in my collection, both of which include superior molars, while a third, which includes two mandibular rami, belongs to it. Of the former the typical and most important specimen includes the following parts. Both maxillary bones with the posterior five molars; the left mandibular ramus with all the alveoli, and the second true molar in place; the glenoid extremity of the scapula; the left ilium; the right astragalus and cuboid.

It is characteristic of the superior molars that the external cusps have a lenticular section, and not a triangular or a round one as in the species of Mioclænus and Chriacus. The external cusp of the first premolar is large and elevated, and has the same fore and aft lenticular section with obtuse cutting edges. The internal table of the crown is of parabolic outline and its edges are right angles. The sides ascend perpendicularly to the alveolar border without the least trace of cingulum or other irregularity. The crown has a weak external cingulum, which does not support any cusps. The posterior of the external cusps of the third molar is well developed, and nearly in longitudinal line with the anterior.

The anterior triangle of the second inferior molar has a broadly rounded external apex, and it is a little elevated above the heel. The latter has two internal marginal cusps, but its summit is so worn that the form of the surface cannot be further determined. No cingula. The manner of mastication is such as to wear the crown obliquely from within outwards in conformity with the form of the inner table of the superior molars. The anterior triangle fits, as usual, between two adjacent superior molars, and the claw-shaped internal border of the superior molar worked, scoop-like across the heel, the inferior molar moving from without inwards. The motion was the same as in Conoryctes. In neither genera do I possess the glenoid surface for the mandibular condyle, but it is highly probable from the evident lateral movement of the lower jaw that neither genus possessed a preglenoid crest as is found in Mioclænus.

The mandibular ramus is slender and moderately stout, especially so at the anterior base of the coronoid process. It follows that the anterior border of the masseteric fossa is well marked, but there is no distinct inferior border. The angle is prominent, straight, and compressed; apex lost. The dental foramen is below the middle of the base of the coronoid; and in line with the alveolar border. The symphyseal surface is smooth. The fourth premolar is close to the canine, and to the third, and has one root. Premolars all closely contiguous. From the appearance of the alveoli the last inferior molar is of reduced size. Enamel everywhere smooth.

Measurements; from one individual.		*M.*
Length of posterior five molars		.021
" " true molars		.0155
Diameters p. m. i	anteroposterior	.005
	vertical, outside	.004
	transverse	.006
Diameters m. ii	anteroposterior	.0055
	vertical, inside	.005
	transverse	.0075
Diameters m. iii	anteroposterior	.0042
	vertical, inside	.0042
	transverse	.006
Length of inferior molar series		.041
" " true molar series		.021
Diameters m. ii	anteroposterior	.007
	transverse	.0045
Depth ramus at m. iii		.015
" " " p. m. iii		.014
Diameters glenoid cavity of scapula	anteroposterior	.016
	transverse	.011
Diameters peduncle of ilium	anteroposterior	.012
	transverse	.009
Greatest diameters of astragalus	anteroposterior	.021
	transverse	.017
Width of trochlea		.0125
" " head		.011
Length of cuboid		.012

The specimens are all from the lowest beds of the Puerco.

MIOCLÆNUS Cope.

Proc. Amer. Phil. Soc., 1881, p. 489; 1883, p. 547; Tertiary Vertebrata, 1885, p. 324.

An examination of my material of species allied to the types of this genus results in the following conclusions:

The fifth or anterior inner cusp of the inferior molars in this genus, displays various conditions of development down to absence. In the species which I formerly

referred to Sarcothraustes it is well developed, although small and conic in shape, and occupies an elevated position on the inner side of the front of the crown, close to the fourth cusp. In the *M. interruptus*, it is less distinctly developed, and is wanting from the last molar in some of the specimens. In *M. acolytus* the fifth cusp adheres closely to the fourth, and is in some specimens wanting. In the *M. subtrigonus* the fifth cusp is indifferently absent, or present in small development on the second and third molars. In nearly all the species of the genus as here constituted the fifth cusp is present on the first inferior true molar; but in the *M. turgidus* and species most nearly related, it is absent. The species of the latter type differ from the forms allied to *M. coryphæus* and *M. ferox* in their robust premolars, but the *M. opisthacus* furnishes a passage between the two. It does not seem practicable to divide the genus, as I once proposed,* on the presence or absence of an interior cusp of the third superior premolar. While this cusp is present in the *M. turgidus*, it is wanting† in the nearly allied *M. zittelianus*, and the *M. opisthacus*.

In the species referred to the second section of the genus (Goniacodon, type *M. levisanus*), the fifth cusp is quite distinct, but is median in position and near the base of the crown (except in *M. heilprinianus*), forming an anterior angle in the outline of the crown. These species I have referred sometimes to Triïsodon and sometimes to Diacodon, but I think I have now found their proper position.

With six new species now added, the total of those embraced in the genus is twenty-four.

Parts of the skeleton of *M. antiquus*, *M. coryphæus*, *M. levisanus*, *M. floverianus*, *M. corrugatus* and *M. ferox* are preserved, and do not present any but specific differences. I must here correct an error into which I fell in describing the *M. ferox* (Tertiary Vertebrata, p. 331) in calling the fibula the radius (Plate XXIV f, fig. 11). The distal part of this element is very robust in that species.

I. Inferior true molars with anterior triangle of three cusps (*Sarcothraustes*).

Length of inferior premolars, .069; depth of ramus at p. m. iv, .055; superior true molar ii, .022 by .016, *M. antiquus*.

Inferior true molars, .052; premolars, .043; infer. m. iii, .015; depth of ramus at m. i, .052; length sup. true molars, .040..... *M. conidens*.

Inferior true molars, .037; premolars, .047; depth ramus at p. m. iv, .041..... *M. bathygnathus*.

Last inferior true molar, .012; depth of ramus at m. ii, .036..... *M. crassicuspis*.

Inferior molars, .037; m. iii, .012; premolars, .037; sup. molars, .030; depth ramus at m. iii, .027..... *M. coryphæus*.

Inferior molars, .030, wide; premolars, .030, close together, the first subconic; ramus at m. i, .020..... *M. pentacus*.

Superior molars, .020; depth ramus at inferior m. ii, .025..... *M. gaudrianus*.

Inferior true molars, .019; premolars, .018, the anterior spaced, the first anteroposteriorly short; depth ramus at m. i, .012..... *M. interruptus*.

Inferior true molars, .018 with anterior elevated ledge and basin-like heel; depth at m. i, .014..... *M. lydekkerianus*.

* Proc. Amer. Phil. Soc., 1883, p. 312. † Genus Oxyclænus Cope, l. c.

Inferior molars, .017 ; the first small, the last large, .0065 ; depth of ramus at m. i, .012.....*M. filholianus.*
Inferior molars, .011 ; fifth lobe small, heel with one cusp ; depth ramus at m. ii, .007.....*M. acolytus.*

II. Inferior true molars with anterior inner tubercle submedian and depressed (*Goniacodon*).

Inferior true molar i or ii, .011 ; fifth cusp elevated, inner edge of heel crenate .....*M. heilprinianus.*
Inferior true molars, .0115 ; anterior paired cusps much elevated ; last molar elongate, .007.....*M. assurgens.*
Inferior true molars, .022 ; last inferior and superior molars reduced, the inferior, .007.....*M. levisanus.*
Inferior true molars, .040 ; last molar large, estimated, .012 ; ramus deep ; fifth cusp low, heel not crenate inside *M. rusticus.*

III. Inferior true molars (except first) without anterior inner fifth tubercle (*Mioclænus*).

A Premolars of smaller diameters than true molars.

a Heels of inferior molars supporting cusps.

ββ Superior molars subtriangular, rounded at inner angle.

Superior true molars wide, .017, with small tubercle between external cusps, and strong posterior internal cingulum ; inferior molars, .023 ; depth of ramus at m. i, .012. .....*M. subtrigonus.*
Superior true molars, .019 ; external cusps close together and without intermediate cusp.....*M. cuspidatus.*
Superior true molars wide, .021 ; inferior molars, .025 ; premolars, .025 ; depth of ramus at m. i, .015, *M. protogoniöides.*
Inferior true molars, .028, the anterior with a strong anterior fifth cusp.....*M. floverianus.*

aa Heels of inferior molars bounded by a curved crest (anterior inferior true molar with median anterior fifth cusp).

Enamel wrinkled ; length of ramus, .110 ; depth at m. i, .020 ; true molars, .035 ; premolars, .035.....*M. corrugatus.*
Enamel roughish ; length of ramus, .160 ; depth do. at m. i, .034 ; true molars, .038 ; premolars, .041.....*M. ferox.*

AA Superior or inferior premolars of equal or greater transverse diameter than the true molars.

a Heels of inferior molars supporting cusps.

Last superior premolar with large internal cusp ; superior molars, .013 ; inferior molars, .016 ; premolars, .019 ; depth ramus at m. i, .010 ; last molar large.....*M. opisthacus.*

aa Heels of inferior molars supporting a curved crest from an external cusp (last molars small ; no fifth cusp on inferior m. i).

Cusps obtuse, premolars swollen ; superior molars, .018 ; premolars, .029 ; superior p. m. iii and iv, with internal cusps ; depth of ramus at m. i, .012.....*M. turgidus.*
Like last but smaller, and internal cusp wanting on superior p. m. iii, and rudimental on p. m. iv ; superior molars, .015 ; premolars, .022.....*M. zittelianus.*
Much smaller ; inferior molars, .0125 ; depth of ramus at m. i, .007 ; exterior cingulum of superior molars strong ; premolars in both jaws large ; heel of lower molars with high edge.....*M. turgidunculus.*
Still smaller ; superior molars, .008, with strong external cingulum ; premolars not enlarged ; inferior m. iii not much smaller than m. ii.....*M. acolytus.*
Small ; superior molars, .010 ; without external cingulum ; intermediate tubercles very indistinct ; inferior m. iii much smaller than m. ii ; premolars small.....*M. minimus.*

MIOCLÆNUS BATHYGNATHUS sp. nov.

Established on a nearly entire left mandibular ramus which supports the true molar teeth and the second premolar. The species is distinguished at first sight by the relatively large size of the ramus, as compared with the dimensions of the true molars. The latter do not exceed in size those of the *M. ferox*, but the jaw is that of an animal as large as the *M. conidens.*

The ramus is of compressed form, and is rather thin posteriorly. It is deepest below the first true molar. Symphyseal suture very coarse. Coronoid process large.

The condyle is broken off, but it was probably elevated a little above the line of the molars. Masseteric fossa well defined anteriorly, but not inferiorly. The angular region is perfectly flat and straight. The dental foramen is below the middle of the coronoid process, and just below the line of the bases of the crowns of the molars. Mental foramina two, in horizontal line.

The inferior canine was large and compressed; part of its alveolus only remains. The molars and premolars are small. The crowns of the fourth and third premolars are lost, but judging from the extent covered by the two roots of the third, it is as large as or a little larger than the second. The second has a simple slightly compressed conical crown, with a small posterior transverse heel. The first premolar is a large tooth, and judging from the alveoli, of greater anteroposterior extent than any of the true molars. The true molars are somewhat worn with use. The anterior part of the crown is more elevated than the posterior, offering in this a resemblance to the *M. conidens*, and a contrast to the *M. corrugatus* and *M. ferox*. The fifth cusp is entirely on the inner side of the crown, and is close to the fourth, which it did not equal in elevation when unworn. The heel of the third molar is short so that the length of the crown does not exceed that of the second true molar, which is the most robust of the series. There is a cingulum on the external base of the true molars, and another on the internal base of the anterior half of the crown of the same. The enamel is minutely rugose.

Measurements.	*M.*
Estimated length of ramus to below condyle	.185
Depth at m. i	.044
" " m. iii	.040
Width at base of coronoid in front	.015
Length of molar series	.081
" " true molars	.037
Diameter of canine alveolus (greatest)	.020
Diameters base of p. m. i { anteroposterior	.0145
Diameters base of p. m. i { transverse	.009
Diameters m. i { anteroposterior	.011
Diameters m. i { transverse	.0095
Diameters m. ii { anteroposterior	.0125
Diameters m. ii { transverse	.010
Diameters m. iii { anteroposterior	.0125
Diameters m. iii { transverse	.0095

From the lowest bed of the Puerco of New Mexico. D. Baldwin.

If the skull of this animal was proportioned as in allied forms it was about the size of that of the black bear (*Ursus americanus*).

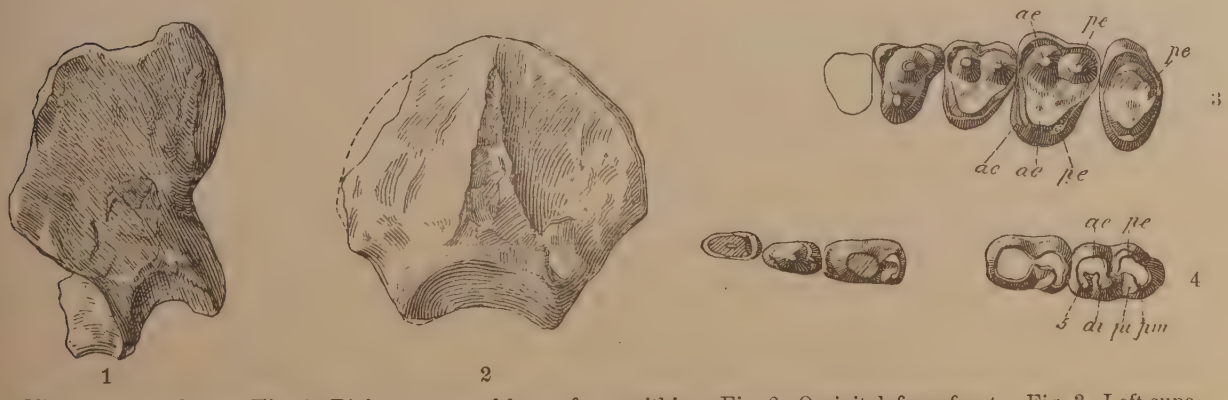
MIOCLÆNUS CRASSICUSPIS Cope. *Conoryctes crassicuspis* Cope; Tertiary Vertebrata, 1885, p. 201, Pl. xxiii c, fig. 6.

Better specimens of the *Conoryctes comma* and of this species show that there is nothing in common between them. The *M. crassicuspis* is allied to the *M. coryphæus*, but has a deeper ramus of the mandible and was probably a considerably larger animal. The last inferior true molar is relatively of smaller size than in that species. Parts of lower jaws of three individuals are in my collection. These show that the fifth cusp is well developed in all of the true molars, and that the anterior part of the crown is higher than the posterior. The type and a second specimen are from the Lower Puerco; the exact horizon of the other is unknown.

MIOCLÆNUS CORYPHÆUS Cope. *Sarcothraustes coryphæus* Cope; Amer. Naturalist, 1885, p. 386.

Nine individuals represent this species in my collection. The best of these includes numerous fragments of a skull with superior molar teeth, and a part of the mandible with the second true molar in a worn condition. The mandibular rami of other individuals furnish the entire inferior series.

The crowns of the superior molars support two external conical cusps which stand close together, but are entirely distinct, and have a circular section. There is a single internal conical cusp flattened on the external side. The entire crown is sur-



1 2

Mioclænus coryphæus.—Fig. 1. Right squamosal bone, from within. Fig. 2. Occipital from front. Fig. 3. Left superior molars, lacking p. m. ii, iii and iv. Fig. 4. Inferior molars lacking m. i, and p. m. iv. All from the typical individual except p. m. i, ii, and iii. Figs. 1–2, seven-ninths natural size; 3–4, about natural size.

rounded by a well-developed cingulum, which is especially prominent round the external anterior cusp of the second and third true molars. The posterior external cusp of the last true molar is rudimental, and is situated well within the external line on the posterior border. The fourth premolar has a single external cusp, and the cingulum is wanting on the anterior and interior sides. The outline of the base of the crown

of this tooth is subtriangular; that of the first and second true molars is a half ellipse; while that of the last true molar is a transverse oval, as in the two species mentioned above. In this last respect it differs from the species of Mesonyx and Dissacus, where that tooth has a triangular base. Enamel delicately wrinkled where unworn. In the *M. antiquus* and *M. conidens*, the first and second true molars have a triangular outline, and there is no internal cingulum.

The occiput of this species rises into an elevated transverse crest with an oval outline, like that of the Dinocerata. This is divided in front by an elevated sagittal crest. The brain cavity is very small. There is a preglenoid crest.

Measurements of Superior Molars.		*M.*
Length of true molars		.031
Diameters of p. m. iv	anteroposterior	.010
	transverse	.012
Diameters of m. ii	anteroposterior	.011
	transverse	.016
Diameters of m. iii	anteroposterior	.008
	transverse	.015
Elevation of occipital crest		.058

The ramus of the mandible has a low and elongate form, and is not very robust. The inferior outline rises below the coronoid process, and the angular region is narrow and compressed. The condyle is produced posteriorly, and its articular face is recurved backwards, and downwards, contracting to an obtuse angle. Its radial line is directed nearly posteriorly. The posterior border of the ramus is concave immediately below it. The dental foramen is below the middle of the coronoid process. The mental foramen is single and is below the p. m. iii. The symphyseal suture is coarse.

The canine tooth is of moderate size (crown broken off). The fourth premolar is one-rooted. The third and second are two-rooted. They are of equal size and small; much smaller than the p. m. i. Their crowns are low, compressed-conic, with a small anterior cingulum and a short carinate heel. The p. m. i is as long anteroposteriorly as any of the molars. Its crown consists of a large compressed-conic cusp directed somewhat obliquely backwards, and a heel supporting two closely-appressed conic cusps. The internal of these is a little posterior to the external; the latter is slightly extended towards the principal cusp. There is a low anterior basal cusp. The anterior part of the true molars is more elevated than the posterior. It consists of three tubercles as already described. The heel supports three cusps; a large external, which has a crescentic section; a minute median, and an anteroposterior interior, which is of medium size, and little elevation. The third true molar differs in having

the median tubercle as large as the external, thus developing a heel. There is a low basal cingulum on all the true molars on the external side, but none on the inner side. The external side of the heel of the p. m. i has a low cingulum. The enamel is minutely rugose, but is worn nearly smooth in old examples.

Measurements of Ramus.	*M.*
Total length	.150
Length of dental series	.088
" " molar "	.073
" " true molar series	.037
" " p. m. i	.0013
Diameters m. i { anteroposterior	.0105
Diameters m. i { transverse	.008
Diameters m. ii { anteroposterior	.0125
Diameters m. ii { transverse	.009
Depth ramus at m. i	.028
" " " m. iii	.028
" " from summit of condyle	.036
Width of coronoid process at anterior base	.015

The mandible from which the above description is taken is that of a different individual whose cranial characters are given on a previous page.

All the specimens are from the Lower Puerco beds.

MIOCLÆNUS PENTACUS sp. nov.

Represented by mandibular rami of seven individuals, which display all the molar teeth except the fourth, which is represented by its alveolus. The character of these teeth is a good deal like that of the *Protogonia puercensis*, but the absence of superior molars prevents my learning whether the species is one of the Phenacodontidæ or not. If it is, it belongs to a genus of that family hitherto undescribed, since the first premolar is absolutely simple, or without internal cusp. This fact prevents my reference of the species to the genus Chriacus, to which the details of the structure of the true molars have much resemblance. My reference of this species to Mioclænus is therefore purely provisional. The very robust form of the first premolar resembles that of the *Haploconus entoconus* rather than that of any species of Mioclænus.

The inferior molars are robust and Phenacodus-like, but the fifth cusp is well developed in all of them, forming an anterior triangle. The three cusps of this triangle are only connected at their bases. The heel is wide and supports a large external marginal cusp and a curved raised margin behind and within, which is notched at two points so as to produce two narrow areas on wear. On the third true molar these are represented by distinct but rather small tubercles. The second true molar

is distinctly larger than the first or the third. The external tubercles of all of the true molars stand within the base of the crown, so that their external faces are unusually oblique. They have a crescentic section, and the posterior sends its anterior ridge obliquely to the base of the posterior of the anterior internal cusps, enclosing a basin as in Chriacus. There is a delicate cingulum round the base of the crown on all except the internal sides. The first premolar is a robust tooth, with a wide narrow heel, and a small anterior basal tubercle, besides the principal subconic cusp. A delicate external basal cingulum. The third premolar has a minute heel, and no external or anterior cingulum. Fourth premolar one-rooted. A short space between third and fourth premolars. Enamel minutely rugose, but polished.

The ramus is not deep, but is robust. Its inferior outline rises posteriorly from below the anterior part of the third true molar. The anterior masseteric ridge is prominent. The coronoid process rises gradually from the third true molar, without carrying that tooth with it. The symphysis extends posteriorly to the line of the posterior border of the third premolar. Mental foramina below the second and fourth premolars.

Measurements.		*M.*
Total length of inferior molar series		.060
Length of true molars		.030
Diameters p. m. i	anteroposterior	.008
	transverse	.0065
Diameters m. i	anteroposterior	.0096
	transverse	.0083
Diameters m. ii	anteroposterior	.0105
	transverse	.0098
Diameters m. iii	anteroposterior	.0105
	transverse	.0083
Depth ramus at p. m. i		.019
" " " m. iii		.021

The seven individuals represented in my collection are all from the Lower Puerco, and the species is probably confined in its range to that horizon.

MIOCLÆNUS GAUDRIANUS sp. nov.

In this species we have a form which in various respects suggests approach to Onychodectes. It is represented in my collection by several fragments of the skull of an individual of medium dimensions in the genus. Both maxillary bones are preserved with most of the molar teeth, and a part of the mandible with the last molars.

The first superior premolar has the principal cusp an acute cone with the section but little compressed. It is joined to an internal cusp whose apex is crescentic.

Externally it is bounded by a strong cingulum whose anterior and posterior extremities rise into strong basal tubercles of crescentic section. The first true molar is considerably smaller than the second, and has a strong posterior inner cingular tubercle, but no internal cingulum. The second true molar has the structural characters of the first. Its external cusps are conic, and are little compressed. There is a strong external cingulum, but no internal cingulum. The third true molar has a very small anteroposterior diameter, and has a very strong external cingulum which increases the transverse diameter of the crown. There are delicate anterior and posterior cingula, which are continuous round the internal base of the crown. In the lower molars the third is considerably smaller than the second, and its keel is but little produced. The anterior part of both molars is elevated above the posterior part.

The ramus mandibuli is characterized by the rapid increase of its depth anterior to the base of the coronoid process, and by the distance of the m. iii anterior to the base of the coronoid process. The anterior border of the masseteric fossa is not very strongly marked. The calcaneum has the form usual in Creodonta. The sustentaculum and internal facets are well spread apart, and the cuboid facet is triangular and oblique to the long axis of the bone.

Measurements.	*M.*
Length of bases of posterior six superior molars	.045
" " " true molars	.021
Diameters of p.m. i anteroposterior	.007
Diameters of p.m. i transverse	.008
Diameters of m. i (transverse)	.008
Diameters of m. ii anteroposterior	.0075
Diameters of m. ii transverse	.0105
Diameters of m. iii anteroposterior	.005
Diameters of m. iii transverse	.009
Length of inferior m. iii	.0085
Diameters inferior m. ii anteroposterior	.009
Diameters inferior m. ii transverse	.005
Depth of ramus at base of coronoid	.020
" " " front of m. ii	.025
Length of calcaneum	.025
" " free calcar	.014

This species has molar teeth about the size of those of the *M. protogonioides*. In that species also, the second superior true molar is larger than the first, but the third is relatively larger than in the *M. gaudrianus*, having two well-developed external cusps. The ramus mandibuli of the *M. protogonioides* does not increase in depth anteriorly, and the inferior m. iii is larger. There is no fifth cusp on the molars.

This species is dedicated to my distinguished friend Prof. Albert Gaudry, Professor of Palæontology in the Jardin des Plantes, Paris. The type specimen comes from the Lower Puerco.

MIOCLÆNUS INTERRUPTUS Cope. *Deltatherium interruptum* Cope, Proc. Amer. Philos. Soc., 1882, p. 463; Tertiary Vertebrata, 1885, p. 282, Pl. XXIII d, fig. 13.

The type and only specimen of this species is imperfect, but presents the character which is shared by no other in this genus, of interspaces between the second, third, and fourth inferior premolars. The fourth premolar is not present in the specimen, whence my former reference of the species to the genus Deltatherium, but the appearance of the surface of the ramus leads me to suspect that the tooth has been lost by accident. The species is further peculiar in the very small anteroposterior diameter of the first premolar, in which it differs from the other species where this tooth is known. The fifth cusp is well-developed on the m. i, but the other inferior molars, with the superior dentition, are unknown.

MIOCLÆNUS LYDEKKERIANUS sp. nov.

This species is characterized by the presence on the inferior molar teeth of a distinct curved ledge in front of the two principal anterior cusps, which terminates in a more or less distinct fifth cusp at its internal extremity. The ledge with its curved anterior edge is unusual in this genus, though more or less developed in some of them, especially the *M. opisthacus*. The present species is much larger than the latter, and exceeds the *M. subtrigonus* also, but is smaller than the *M. protogonioides*.

The heel is rather wide and the edges elevated and with only an external cusp-like elevation, giving a basin-like surface. The last molar is not enlarged or reduced, but is narrower than the m. ii. The crowns are without cingula, and the enamel is obsoletely plicate. No premolars preserved.

Measurements.		*M.*
Length of true molars		.018
" " last true molar		.007
Diameters m. ii	anteroposterior	.006
	transverse	.006
Diameters m. i	anteroposterior	.0055
	transverse	.0055
Depth of ramus at m. i		.014

Portions of three mandibular rami represent this species. It is dedicated to Dr. Richard Lydekker, the distinguished curator of vertebrate palæontology in the British Museum.

MIOCLÆNUS FILHOLIANUS sp. nov.

Parts of both mandibular rami of two individuals represent this species in my collection. One of these presents the five posterior molars in perfect preservation. The characters ally the species to some of those of Chriacus, but the simple first inferior premolar distinguishes it from that genus. After the *M. minimus* and the *M. acolytus* this is the smallest species of Mioclænus, and its inferior molars have the cusps more acute and elevated than in any other.

The molars are distinguished from those of several other species, including *Chriacus schlosserianus*, in that they increase in size, regularly posteriorly. The first is thus much smaller than the third, a proportion which is reversed in many other species. The two anterior cusps are joined much above the level of the heel, which would be thus much below them, but for the fact that its border is much elevated, leaving the median surface a deep basin. The fifth cusp is small and is elevated and close to the fourth, and is connected with the anterior external by a curved crest. The edge of the heel is developed into three small cusps, one median and two lateral. The third true molar is quite elongate, and has six well-developed cusps in all. The first premolar has a short base, and the principal cusp is truncate behind, and has a sharp edge in front. The heel is very short and terminates in a small acute cusp, and there is no anterior basal cusp. The second premolar has a small cuspiform heel. There is a weak cingulum on the first premolar and first true molar, but only traces remain on the m. i and ii. Enamel smooth.

Measurements.		*M.*
Length of true molars		.017
Diameters of m. i	anteroposterior	.0045
	transverse	.003
Diameters of m. ii	anteroposterior	.0052
	transverse	.0035
Diameter of m. iii	anteroposterior	.006
	transverse	.0035
Depth of ramus at front of m. i		.012

The two specimens of this species were found in the lowest beds of the Puerco formation by Mr. David Baldwin. It is dedicated to Dr. Henri Filhol, the distinguished French palæontologist, whose discoveries in the field of extinct Mammalia have been so numerous and important.

MIOCLÆNUS PROTOGONIOIDES Cope; Amer. Naturalist, 1882, p. 833; Tertiary Vertebrata, 1885, p. 340, Pl. XXV f, fig. 17.

This species has been known hitherto by the last two superior molars only. At present I have in addition, a fragment of a maxillary bone with the first and sec-

ond true molars, and a set of jaws of a single broken skull, and also a left mandibular ramus containing all but the canine and fourth premolar teeth. The species is distinguished in the upper series by the relatively considerable development of the second and third superior molars, the third having two well-developed external cusps. Also by the strong development of the intermediate tubercles, and the distinctness of the posterior inner tubercle of the first and second true molars. Though distinct, it is only a small acute elevation of the posterior cingulum. The latter passes round the internal base of the second and third true molars, but not the first.

The ramus of the lower jaw is of moderate and uniform depth throughout, and not convex below, as in *M. gaudrianus*. The second and third true molars have no trace of the fifth cusp; the anterior part of the first is lost. There is a weak median posterior tubercle on the first and second true molars, which is developed into a very large obtuse heel in the third, so that this tooth is longer than either of the other true molars, and reaches to the base of the coronoid process. The first premolar is not relatively so large as it is in some of the species above described. Its principal cusp is but little compressed, and the heel is short and transverse, and has the inner extremity almost cuspidate. A small acute anterior basal cusp. The second premolar has anterior and posterior basal cingula only. The third is a little smaller than the second. The only cingulum of the inferior molars is at the outer base of the anterior half of the crown. This half is a little higher than the posterior half.

Measurements of Ramus.		*M.*
Length of true molar series		.0245
Diameters m. ii	anteroposterior	.0075
	transverse	.0065
Diameters m. iii	anteroposterior	.0095
	transverse	.006
Depth of ramus at end of m. iii		.019
" " " " " m. i		.016

MIOCLÆNUS FLOVERIANUS sp. nov.

This species is indicated by parts of two mandibular rami which display four of the molar teeth, with which were found the following bones of the skeleton: several vertebræ, parts of both humeri, distal end of radius, greater part of right ilium. These all appear to be parts of the same skeleton.

The first true molar has a well-developed fifth cusp which is median in position and larger and lower than the fourth cusp, from which it is well separated in position. There is no trace of fifth cusp on the other true molars, but there is a median posterior of small size on the m. ii. The last inferior molar is not reduced as in some spe-

cies, but is smaller than the penultimate, and has but a short heel. The first premolar is about the length of the first true molar. It is robust, and the cusp is a little compressed, but is flattened behind. The heel is very short and is convex posteriorly. A very small anterior basal cusp. The anterior part of the crown of the m. i is higher than the posterior, which only supports one tubercle, the external. The inequality between the anterior and posterior tubercles of the third true molar is unnoticeable. No cingula on molars or premolars.

There are two lumbar and one caudal vertebræ. The centra are depressed by pressure; arches lost. The caudal vertebra is one of the proximals. It is robust, and indicates a well-developed tail. The head of the humerus is extended in the direction of the greater tuberosity. The latter is large and truncate both proximally and externally; at the posterior external angle is a distinct *fossa m. teretis*. The bicipital groove is wide. The lesser tuberosity is bounded by an angle, which rises proximad and towards the greater tuberosity. The deltoid ridge extends to below the middle of the shaft. The internal condyle is large and compressed so as to be vertical; it is pierced vertico-obliquely by the large entepicondylar canal. The external epicondyle is very little prominent, and is mostly occupied by its fossa. The transverse extent of the condyles is not very great. The lateral borders of its posterior groove are sharp. The convexity of the roller is pronounced but not approaching an intertrochlear crest. The distal extremity of the radius is wider than deep and the outer side is truncate, so that the section of the shaft is a triangle. At the extremity the ulnar side is grooved, and above the prominent superior border of this groove is another, which is bounded above by a short robust flat ridge. The outlines of the scaphoid and lunar fossæ are distinct except where they pass into each other.

The ilium is robust, and at the peduncle the anterior or inferior face is nearly as wide as the interior. At the sacral articulation it is moderately expanded. The anterior inferior spine or tuberosity is moderately prominent, and is situated a considerable distance proximad of the acetabulum, opposite the narrowest part of the peduncle.

Measurements.		*M.*
Length m. i		.009
Width " posteriorly		.0065
Diameters m. ii	anteroposterior	.009
	transverse	.0075
Diameters m. iii	anteroposterior	.009
	transverse	.007
Diameters p. m. i	anteroposterior	.009
	transverse	.005
Length of centrum of lumbar vertebra		.022

Measurements.		*M.*
Diameters of head of humerus	long, with great tuberosity	.021
	short, " small "	.017
Least diameter of shaft do.		.005
Width of distal end do.		.025
" " condyles in front		.015
Diameters distal end of radius	transverse	.0105
	vertical	.009
Ilium anterior width of peduncle		.010
" external " " "		.014

This species is one of medium size in the genus. It is quite of the type of the *M. ferox* and *M. corrugatus*. Its inferior molar teeth are considerably larger than those of the *M. protogonioides*, and the last one is shorter in relation to its length. It is dedicated to Professor W. H. Flower, Director of the Natural History Department of the British Museum.

MIOCLÆNUS CORRUGATUS Cope; Proc. Amer. Phil. Soc., 1883, p. 560; Tertiary Mammalia, 1885, p. 341, Pl. XXIV f, fig. 5; XXIV g, fig. 8.

The discovery of nearly entire mandibular rami of this species and of *M. ferox* enables me to determine the distinctive characters of the two species better than heretofore. While the true molar teeth in the two are of nearly equal size, or at least within the range of variation not unusual in a variable species, the mandibular ramus of the *M. corrugatus* is very much smaller every way than that of the *M. ferox*. The shortening influences the length of the premolar series, which is much shorter in the *M. corrugatus*, the teeth being crowded, while in the *M. ferox* they are (the second, third and fourth) separated by interspaces. An astragalus which accompanies the jaws of *M. corrugatus* is identical in character with that of the *M. ferox* but of smaller size.

MIOCLÆNUS OPISTHACUS Cope; Amer. Naturalist, 1882, p. 833. *Hemithlæus opisthacus* Cope; Tertiary Vertebrata, p. 407, Pl. XXV f, figs. 8–9.

The typical specimens of this species include parts of four mandibular rami with teeth, and a single superior molar, which is that of a species of Hemithlæus. The association of this superior molar with the mandibles cannot be demonstrated. I have subsequently received a mandibular ramus with nearly complete dental series, associated with a portion of a skull which contains the true molars and the first premolar in a perfect state of preservation. Everything inspires the belief that these are parts of the same animal. In addition I have parts of both rami of a sixth individual which support most of the teeth; and a maxillary bone with m. ii, m. i and p. m. i, with parts of mandibles of a seventh, and mandibles of five other individuals.

This species exhibits characters intermediate between the types with robust premolars, and those with premolars of narrower and more angular form. The second superior premolar has no internal cusp and is trenchant, but the first has a very large internal cusp, whose base is as large as that of the external one, and which has slight anterior and posterior cingula, but no internal or external ones. It resembles the corresponding tooth of some of the Periptychidæ. The true molars are those of this genus, resembling those of the *M. subtrigonus*. The external cusps are distinct and not compressed. The crown is surrounded by a cingulum except on the internal side. The cingulum rises into a small cusp between the external cusps, and into a small but distinct posterior internal cusp. In the inferior series the first and second premolars are enlarged and have longitudinally oval bases; both have posterior heels,

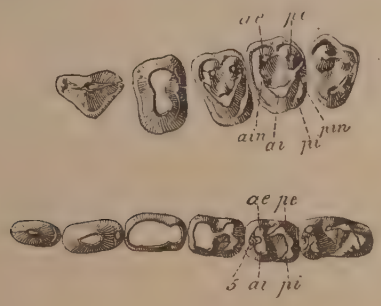


Fig. 5.

Fig. 6.

Fig. 5. *Mioclænus opisthacus* molars of both series ⅔ natural size: the cusps are lettered; *ae*, anterior external; *pe*, posterior external; *ain*, anterior intermediate; *pin*, posterior intermediate; *ai*, anterior internal; *pi*, posterior internal; *5*, fifth cusp.

Fig. 6. *Chriacus priscus* ⅔ natural size; teeth of both jaws.

and the first has a small anterior one; both are like those of Anisonchus. The inferior true molars illustrate the transitional condition of the fifth cusp in this genus. A narrow crest descends inwards from the anterior external cusp, but terminates below the level of the fourth, or opposite inner cusp, and there is no fifth cusp, or but a rudiment in the m. iii of one of the specimens.

Measurements of Fifth Specimen.	*M.*
Length of superior true molars	.014
Diameters of superior p. m. i { anteroposterior	.0045
Diameters of superior p. m. i { transverse.	.007
Diameters of superior p.m. ii (spec. No. 7) { anteroposterior	.006
Diameters of superior p.m. ii (spec. No. 7) { transverse	.004
Length of inferior molars (except p. m. iv)	.0335
" " " true molars	.0155
" " " p. m. i.	.0058
Width of inferior p. m. i.	.003
Length of inferior m. iii.	.006
Width " " "	.003
Depth of ramus at m. i	.010

MIOCLÆNUS ZITTELIANUS sp. nov.

This species is represented by a skull which lacks the occipital region. It is enclosed in a silico-calcareous concretion, and the teeth have been cleanly exposed by weathering, but the surface of the skull is not cleaned. Large parts of both mandibular rami with their teeth are preserved.

The dental characters resemble those of the *M. turgidus*, but differ in the absence of internal cusps of the superior premolars. The dimensions are smaller, especially those of the premolar teeth. The last molar in both jaws is much smaller than the others, as in *M. turgidus*, and the intermediate tubercles in the superior molars are present, but small. The external cingulum is distinct on the superior true molars, but wanting on the premolars. The same is true of the anterior and posterior cingula, while internal cingula are absent from all the teeth. The heels are rudimental on the first and second inferior premolars.

Measurements.	*M.*
Length of superior molar series	.036
" " " true molars	.014
Diameters superior p. m. i, anteroposterior	.0055
Diameters superior p. m. i, transverse	.007
Diameters superior m. ii, anteroposterior	.0055
Diameters superior m. ii, transverse	.0072
Width between p. m. ii on palate	.0075
" " m. ii on palate	.015

From the Upper Puerco. Dedicated to Professor Karl Zittel, of the University of Munich, and Director of the Museum.

MIOCLÆNUS TURGIDUNCULUS sp. nov.

This species is primarily indicated by a portion of a left maxillary bone which supports the first two true molars, and the first premolar. There is a mandibular ramus supporting the corresponding teeth of the inferior series, which probably belongs to the same species, and the posterior parts of two other rami, each supporting the last two molars, are also referred to it.

The peculiarity of the superior molars consists in the strong external cingulum and intermediate tubercles, and the large size of the first premolar, and especially of its internal cusp, in which respects it resembles that of the *Mioclænus opisthacus*. It has no cingula whatever, except a trace at the anterior and posterior external angles. There are anterior and posterior, but no internal cingula of the true molars. In the *M. minimus* the molars have no cingula, except faint traces of the anterior and posterior, and the intermediate tubercles are wanting.

The inferior molars are referred to this species because of the large size of the premolars, which approach in dimensions those of the *M. zittelianus*. The first has a low wide heel, and no anterior basal angle. The fifth cusp exists as a cusp on the m. i and ii. The curved border of the heel in these teeth is more elevated than in the *M. minimus* on the inner side, so as to enclose a deep basin, which is much better defined than in *M. minimus*. In the third and fourth individuals, where the last inferior molar is preserved, this tooth is smaller than the m. ii, and both of these teeth have the fifth cusp present, but small, and appressed as a small twin on the anterior face of the fourth. This occurs also in the *M. acolytus*, and I do not believe that the character is constant.

Measurements.	*M.*
Length of superior molars (last estimated)	.011
Diameters m. ii anteroposterior	.005
Diameters m. ii transverse	.0055
Diameters m. i anteroposterior	.004
Diameters m. i transverse	.0045
Diameters p. m. i anteroposterior	.0045
Diameters p. m. i transverse	.006
Length inferior true molars (sp. 2)	.0125
" " p. m. i	.005
Depth ramus at m. ii	.0075

The typical specimen is from the lowest beds of the Puerco. D. Baldwin.

MIOCLÆNUS ACOLYTUS Cope. *Hyopsodus acolytus* Cope; Proc. Amer. Phil. Soc., 1882, p. 462; Tertiary Vertebrata, 1885, p. 238, Pl. XXIII d, figs. 5–6.

Additional specimens of this species show that it differs from the *M. minimus* in the presence of a strong external cingulum of the superior true molars, and the less reduced size of the last inferior molar. A single specimen, figured as above, displays the first two true molars and the first premolar above, and both the last inferior molars of the same skull. From the *M. turgidunculus* this species is easily distinguished by the small first and second premolars in both jaws. A damaged skull, without lower jaw, shows this character, as well as the type, and also that the fourth superior premolar has but one root, and is of small size; also that the canine is well developed and has a vertical direction. The second superior premolar has an internal cingulum, but no cusp.

Measurements of Skull.	*M.*
Length of superior dental series	.0252
" " " true molars	.009
Width between superior canines	.011

Five specimens; all from the Upper Puerco except one, and the specific reference of this one is uncertain.

The tritubercular superior molars and simple premolars show that this species cannot be referred to the genus Hyopsodus.

The number of the superior premolars of the allied *M. minimus* is unknown, so that it may be a Tricentes. In this genus it can be only compared with the *T. inæquidens* (Fig. 8), which is of about the same size. But in that species the last molar is still more reduced than in *M. minimus*.

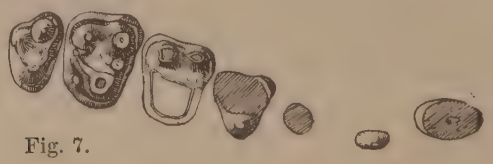


Fig. 7.

Fig. 7. *Tricentes bucculentus* ⅔ natural size.

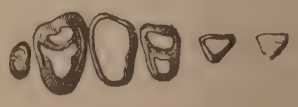


Fig 8.

Fig. 8. *Tricentes inæquidens* ⅔ natural size.

CHRIACUS Cope.

Proc. Amer. Phil. Soc., 1883, p. 314; Tertiary Vertebrata, 1885, p. 740.

In the absence of sufficient knowledge of the skeleton in this genus I find its distinction from Mioclænus to rest on dental characters. It differs from that genus in the presence of an internal cusp of the first inferior premolar, which is however but little developed in some of the species. The molars of the inferior series may be usually easily distinguished from those of Mioclænus in the well-developed fifth cusp, and in the trihedral cusp of the external side of the heel, which with the raised internal border gives the heel the basin-like character which is seen in Pelycodus. The character of the inferior molars graduates into that of Mioclænus through such species as *M. subtrigonus* and *C. schlosserianus*.

The species are difficult to distinguish with the material in my possession. I recognize ten from the Puerco and one from the Wasatch. The former are distinguished as follows. Owing to the absence of corresponding parts I am obliged to compare the superior and inferior dental series in separate tables:

Species with Superior Molars.

I. Posterior cingulum and its interior cusp large, forming a prominent angle of the crown.

Larger; true molars .0185 ..... *C. pelvidens.*

Smaller; true molars .014 (Fig. 9) ..... *C. truncatus.*

II. Posterior cingulum and cusp small or insignificant.

a. Superior molars wider than long.

Largest; molars .0195; depth of ramus at m. 1 .012 ..... *C. priscus.*

Medium; molars .015; depth of ramus .011 ..... *C. schlosserianus.*

Smallest; molars .010; depth of ramus .007 ..... *C. simplex.*

aa. Superior molars longer than wide.

Medium; molars .0165 ..... *C. hyattianus.*

Species with Inferior Molars only.

I. Size large; premolars unknown.

Inferior true molars .0285; depth ramus at m. i .015 ..... *C. ruetimeyeranus.*

II. Size smaller; premolars not spaced.

Inferior true molars .023, last large; ramus .018 ..... *C. pelvidens.*

Inferior true molars .017, the last small, the first not reduced; ramus .011 ..... *C. schlosserianus.*

III. Size smaller; spaces between p. ms. ii, iii and iv.

True molars .018, fifth cusp very distinct from fourth; molar series .043 ..... *C. baldwini.*

True molars .024, fifth cusp divergent, connected with fourth by a crest; molar series .050 ..... *C. stenops.*

IV. Smaller; third premolar larger than second.

Depth of ramus at p. m. i .010 ..... *C. inversus.*

Fig. 9.

Fig. 9. *Chriacus truncatus* $\frac{3}{2}$ natural size.

Fig. 10.

Fig. 10. *Indrodon malaris* $\frac{3}{2}$ natural size.

CHRIACUS PRISCUS sp. nov. Fig. 6.

This species is represented primarily by a fragmentary skull of which there remain, the superior walls of the brain case, a part of the left maxillary bone, which supports the posterior five molars; part of the right maxillary with three molars, and part of the right mandibular ramus with the anterior two true molars. There are associated as cospecific with this individual, a second, represented by superior and inferior molars; a third represented by superior molars only, and two others represented by mandibular rami only; in all, five individuals. All are from the lowest beds of the Puerco.

The superior molars are of the same size as those of the *C. pelvidens*, but are very different in form. The absence of the strong internal angles of the crown at the inner extremities of the anterior and posterior cingula, is one character. The straight outline with an open margination of the external side of the crown in *C. pelvidens* is in strong contrast with the two convexities, each following an external cusp which form the outline in the *C. priscus*. The first premolar has a small internal cusp in the *C. priscus;* a large one in the *C. pelvidens*. It is represented by an angular cingulum in the *C. priscus*. In this species the cingulum does not extend round the inner base of the crown, except weakly in the last molar.

The inferior molars have a relatively greater transverse diameter than those of any other species of the genus. They also differ from those of the *C. pelvidens* and *C. stenops*, which they resemble in size, in the nearly equal elevation of the anterior and posterior cusps, and in the absence of an external basal cingulum. The fifth

cusp is a small cone, and is not spread away from the fourth and connected with it by a crest, as in *C. stenops*. In specimens with the last inferior molar preserved, that tooth is seen to be of average proportions.

The brain-case is long, narrow and rather low, and the sagittal crest is low and thin. It does not in the least resemble that of Adapis, but is rather that of a Creodont. Postorbital region lost.

Measurements.		*M.*
Length of five superior molars		.031
Diameters p. m. i	anteroposterior	.0055
	transverse	.0055
Diameters m. ii	anteroposterior	.007
	transverse	.0085
Diameters m. iii	anteroposterior	.0055
	transverse	.0075
Diameters inferior m. ii	anteroposterior	.007
	transverse	.0065
Diameters m. i	anteroposterior	.006
	transverse	.006
Depth of ramus at m. i		.012

CHRIACUS SCHLOSSERIANUS sp. nov.

Parts of four individuals represent this species. Three of these are from the Upper Puerco; the exact horizon of the fourth is probably the same, as those from the Lower Puerco are especially marked in my collection. The typical specimen includes parts of both maxillaries with molars; both mandibular rami, one nearly perfect and supporting the last four molars; parts of both humeri, an ulna and part of the right astragalus. The species is smaller than the *C. priscus*, and has about the dimensions of the *Mioclænus subtrigonus*.

The posterior internal cingular cusp of the second superior molar is better developed than in the *C. priscus*, but nothing like that seen in the *C. pelvidens* and *C. truncatus*. The cingulum continues round the internal side of the crown in the second and third molars (first injured). External cingulum present. Last molar of relatively small size, about as in *Mioclænus turgidus*, but larger than in *Tricentes inæquidens*. Internal cusp of p. m. i small. The inferior series is distinguished by the small size of the third. The anterior part of the crown of the inferior molars has a distinctive character. The fifth cusp is not distinctly defined, but the anterior part of the crown forms a three-side prism, the anterior edge, or that connecting the external anterior cusp with the fifth, being very well defined. On wearing, the summit forms a narrow V with the apex external. External cingulum complete on the second true molar only. The first premolar is of moderate size, and has an anterior

cusp of an elevation equal to the internal cusp. There are no interspaces between the first, second and third premolars, and probably not behind the fourth, as the jaw is shallow and tapers rapidly. It is, however, deeper than in the *C. simplex*. Mental foramina below the second and fourth premolars.

There is nothing noteworthy in the humerus. The astragalus has but a short anteroposterior trochlear surface, and it extends well on the neck, indicating a plantigrade foot. It is slightly concave transversely. The malleolar face is oblique, and projects posteriorly beyond the fibular face, which is vertical. The base of the posterior notch bridges the minute median foramen. The ulna is much compressed, and has a large olecranon. The humeral cotylus is diagonal to the long diameter of the shaft, and has a marginal flange behind on the interior side, and in front on the exterior side. The radial face is absolutely flat and is directed inwards at an angle of thirty degrees from the vertical. It indicates a flat head of the radius, without rotary capacity. Below the superior border of the ulna, on the external side, is a deep groove which extends to the edge of the flange of the humeral cotylus.

Measurements.		*M.*
Length of superior true molars		.015
Diameters of m. iii	anteroposterior	.0062
	transverse	.0035
Diameters of m. ii	anteroposterior	.006
	transverse	.008
Diameters of p.m. i	anteroposterior	.0055
	transverse	.004
Length of inferior molars less m. i		.029
" " " true molars		.017
" " " molar iii		.0055
Diameters m. ii	anteroposterior	.0055
	transverse	.0045
Depth of ramus at m. i		.010
Width of distal condyle of humerus in front		.011
Diameter shaft humerus at middle	anteroposterior	.006
	transverse	.007
Depth of ulna	at olecranon	.009
	at cotylus	.0065
	at coronoid	.009
Width of astragalus		.008
Width of trochlea		.005
Height of trochlea, external side		.0045

This species is dedicated to my friend Dr. Max Schlosser, of Munich, whose works on the extinct Mammalia are among the most important of modern times.

CHRIACUS RUETIMEYERANUS sp. nov.

This is the largest species referred to the genus, and is the only one as yet represented by a single individual. I possess part of the left mandibular ramus which exhibits the true molars, and the roots of the first and second premolars.

The last molar is as large as the second, and its anterior cusps are not opposite to each other as in other species of Chriacus, but the external is in advance of the internal. The fifth cusp is not elevated as in other species, but is represented by an internal angle of an interior ledge, which is quite wide. The anterior cusps of the m. i are opposite, those of m. ii are injured. The heel has the external cusp of crescentic section, and the internal elevated border. No cingula. Enamel obsoletely coarsely rugose. The heel of the m. iii is well developed, as are also the adjacent internal and external marginal cusps.

Measurements.		*M.*
Diameters m. i	anteroposterior	.009
	transverse	.005
Diameters m. iii	anteroposterior	.010
	transverse	.0055
Depth of ramus at posterior end of m. i		.016
" " " " m. iii		.021

From the lowest Puerco beds. Dedicated to Prof. L. Ruetimeyer, the distinguished palæontologist of Basle.

CHRIACUS BALDWINI Cope. *Deltatherium baldwini* Cope; Proc. Amer. Phil. Soc., 1882, p. 463; Tertiary Vertebrata, 1885, p. 282, Pl. XXIII d, fig. 12.

Besides the type of this species, I have obtained since its description, the greater part of the mandibular ramus with teeth with several parts of the skeleton, of one individual, and both mandibular rami with most of the teeth of a third individual. Parts of the rami of a fourth individual may belong to the species.

The complete rami show that their anterior portions are produced, and that the premolar teeth in front of the second are spaced. The second and third are close together. The true molars themselves are a good deal like those of the *M. subtrigonus* with fifth cusp. The internal cusp of the first premolar is rudimental in this species. The premolars of the *M. subtrigonus* are not spaced. The fifth cusp is small, distinct, and not involved in a crest. There is a small median cusp of the heel. The first premolar has a distinct heel. The enamel of the molars is coarsely rugose, a surface which long use does not entirely smooth. No cingula in one specimen, but in the type and second specimen there is a rather weak one on the external side. The mandibular condyle is entirely above the level of the molars in sp. No. 3. The last inferior molar is not of reduced size. Ramus slender.

The femur of the second specimen is nearly perfect. The trochanters are well developed; the great extending proximad to the head, and connected by a curved ridge with the less. Third trochanter superior in position, its superior part overlapping the line of the inferior part of the lesser. Head without fossa or notch *ligamenti teris.* Rotular face elevated, wide, with equal borders and slight concavity. Condyles well separated.

Measurements of No. 2.	*M.*
Length of inferior molar series	.043
" " " true molars	.0205
" " " " m. iii.	.007
Depth of ramus at m. i.	.015
" " p. m. iv.	.009
Length of femur (greatest).	.098
Width at head.	.022
" " middle of shaft (crushed)	.011
" " condyles.	.017

CHRIACUS STENOPS sp. nov.

Four mandibular rami of three individuals represent this species. Two of the rami are entire to the base of the canine tooth. These show interspaces between the second and third and third and fourth premolars, not seen in such species as *C. pelvidens* and *C. schlosserianus.* It resembles in this respect the *C. baldwini*, but differs from it in characters already mentioned, and in its superior size. The internal cusp of the first inferior premolar is also much better developed.

The anterior cusps of the true molars are more elevated than the posterior, but the difference is not so great as in some other species. The fifth is a prominent angle, nearly in line with the fourth, and connected with it by a crest. The heel has an external angular cusp with crescentic section, well distinguished from an internal curved border which is connected with a small median posterior angle. This becomes a prominent cusp in the third molar, which is of average size. Molars with an external cingulum. Enamel coarsely and obsoletely rugose in unused specimens. The first premolar has a well-developed transverse heel, and anterior basal cusp. The second has the same, but of reduced proportions.

In a specimen (No. 3) cleaned by weathering, the posterior border of the symphysis is opposite the posterior border of the p. m. iii; the two mental foramina are below p. m. ii, and the space between p. m. iii and iv.

Measurements No. 1.	*M.*
Length of dental series including canine.	.055
" " molar series	.049
" " true molar series	.024

Measurements No. 1.		*M.*
Diameters m. i	anteroposterior	.0073
	transverse	.0055
Diameters m. iii	anteroposterior	.008
	transverse	.0055

No. 3.

Length of premolar series	.026
Depth of ramus at m. i	.013
" " " " p. m. iv	.008

All the specimens of this species are from the Upper Puerco.

CHRIACUS INVERSUS sp. nov.

The characters of this species are so well marked that I introduce it here, although the material representing it is slight, a portion of a single mandibular ramus which supports three premolars, and one true molar. The posterior part of a ramus accompanies this specimen and may belong to the same species. But of this there is doubt.

The first premolar has a well-developed interior cusp, and a large heel. The latter has an internal vertical, and an external oblique side, terminating in a cutting edge, the internal curving round the posterior border to meet the external. There is no anterior basal cusp, nor any cingulum. The second and third premolars are compressed, and have cutting edges before and behind. The second has the heel slightly transverse, and a mere trace of anterior basal lobe. The third is larger than the second and is more compressed. Externally its face is regularly convex, but internally its convexity is a vertical median rib, and in front of this the face is concave, thus maintaining the acuteness of the anterior cutting edge on wear. The heel is small and compressed; anterior lobe none. The enamel of all the teeth is smooth. No cingula.

Measurements.	*M.*
Length of posterior three premolars	.015
" " p. m. iv	.007
Width " " "	.0038
Depth of ramus at front of m. i	.0115

TRIÏSODON Cope.

Amer. Naturalist, 1881, p. 667; Tertiary Vertebrata, 1885, p. 270.

But one species of this genus is described, although several have been referred to it. All but the type species have found a congenial location in the genus Mioclænus (group Goniacodon). I am now able, however, to add a second species of typical form.

TRIÏSODON BICULMINATUS sp. nov.

Parts of the mandibular rami of two individuals indicate this species. One of these supports the first and second true molars, and the other the first true molar only. The character of the genus is seen in the great development of the external cusp of the heel, and the absence of an internal cusp, so that the heel appears to have one cusp with an oblique cutting edge, resembling in this respect Palæonyctis. The two principal anterior cusps are opposite each other and united for half their elevation, and the internal is larger relatively than in the *T. quivirensis*. The fifth cusp is low, forming a distinct tubercle in the first molar only, and represented by the internal angle of an anterior ledge in the second. The heels of both the molars have three small tubercles on the posterointernal border, which are not so much elevated as the corresponding ones in the *T. quivirensis*. A weak external cingulum only. Enamel obsoletely coarsely rugose with minute tubercles.

Measurements.		*M.*
Diameters m. i	anteroposterior	.011
	transverse	.008
Diameters m. ii	anteroposterior	.012
	transverse	.0095
Depth of ramus at m. i		.020

From the bottom of the Puerco beds.

DISSACUS Cope.

Amer. Naturalist, 1881, p. 1019; Tertiary Vertebrata, 1885, p. 344, 741.

Numerous pieces of the skeleton associated with molar teeth which agree with those of the *D. navajovius*, throw much light on its characters, and on the position of the genus Dissacus. In the first place the zygapophyseal articulations of the lumbar vertebræ are of the involute type common to all the Creodonta. This is also determinable from the specimen described by me in the Tertiary Vertebrata, p. 741. In the new skeleton the fragments of metapodials, probably metatarsals, furnish evidence of the existence of five digits, which distinguishes the genus from Mesonyx, where there are but four. The astragalus is especially interesting in its relation to that of Mesonyx. It has, as in that genus, a distinct cuboid facet, separated from that of the navicular by an angle, but the angle is not as well defined as in Mesonyx and Pachyæna. The trochlea is very slightly concave, thus differing widely from that of the Mesonychidæ, and resembling that of other Creodonta. This bone therefore furnishes a clear guide to the phylogeny of the Mesonychidæ. The two facets are well defined on the proximal extremity of the cuboid. Its distal extremity supports but one, a

concave facet. The tubercalcis, like the olecranon, is elongate. The coracoid is distinct but short. The peduncle of the ilium is wide. The odontoid process is rather long and cylindric. There is an entepicondylar foramen, as in Pachyæna.

DISSACUS NAVAJOVIUS Cope, loc. cit.; Tertiary Vertebrata, Pl. XXV c, fig. 1.

The paradiapophysis of the atlas has the base extended throughout the vertebra anteroposteriorly, and the vertebrarterial canal divides it anteroposteriorly, issuing at about the middle of the superior surface. The atlantal articular surfaces of the axis are distinct from those of the odontoid. The floor of the neural canal has a low median convex ridge, which extends to near the end of the superior side of the odontoid process, from which it is separated, as well as from the articular faces below, by a shallow groove.

The glenoid cavity of the scapula is an oval, gradually acuminating to the narrow origin of the coracoid. The spine originates abruptly a little posterior to the middle line. In the humerus the entepicondyle is of moderate dimensions, much larger than in Mesonyx, but less prominent than in many other Creodonta. Outside the roller of the condyle there is a distinct border facet, rising to its external border, which is present in Mesonyx, but is wanting in Oxyæna. The roller is distinctly convex. The internal flange is well developed. In the ulna, the olecranon is long, straight and compressed. Its inferior border is of uniform width from below the glenoid surface to the extremity, and is but little in excess of that of the shaft further forwards. The posterior flange for the humerus is not present on the external side of the glenoid surface. The radial facet is not very oblique, and it is followed distally on the external side by a deep groove, which runs out on the external side of the shaft. The latter is marked by a deep and wide longitudinal gutter on its internal side, which is bounded by a narrow edge above, and a wide border below. It runs out on the inner side of the shaft proximally, opposite the middle of the external groove. This gutter is wider and deeper in this species than in any creodont known to me, excepting the *Pachyæna ossifraga*. The head of the radius is a depressed oval, with three articular surfaces; a median concave, and a narrower reflected bevel at each end, fitting corresponding faces of the humerus. The inferior ligamentous fossa is wide and shallow.

The femur is not preserved excepting the head, which shows a rather shallow fossa ligamenti teris, which is well separated from the border. The astragalar face of the tibia is quite oblique, especially next to the fibular suture. The internal malleolus is large, vertical, truncate and furnished with a tuberosity in front of the distal extremity. The articular surface is folded back over the anterior edge for a short

distance on the anterior face, to correspond with the fossa of the neck of the astragalus. The astragalus is somewhat depressed, and is quite oblique to the vertical plane. The neck is of moderate length, and is depressed, and the navicular facet slopes at an angle of forty-five degrees when the astragalus rests on a plane surface. The long axis of the trochlea slopes at an angle of thirty degrees to the long axis of the entire bone, outwards and forwards. The posterior foramen is completely enclosed. The malleolar face is oblique, the fibular vertical. The articular surface of the trochlea is continued in an excavation of the neck to its middle, and is terminated by an acute recurved boundary. This indicates a foot frequently held at right angles to the leg, and a plantigrade walk. The obliquity of the astragalus, which fits the tibia perfectly, means that the hind legs diverged to the feet in a very obvious manner. If the calcaneum is placed on a plane surface this divergence is still greater, since the calcaneum is obliquely related to the astragalus, as the latter is to the tibia. The animal may have, however, walked on the external edge of the foot. The sustentaculum is not very large as compared with the cuboid facet. The latter is trapezoid in outline, the four sides all unequal, being related as to length in the following order, beginning with the longest—inferior, superior external, superior internal, internal. When the astragalar facets are held in a horizontal plane, the long axis of this face is horizontal. In this position, the inferior surface of the calcaneum is a narrow obtuse ridge, bounded on the external side by a wide deep gutter. This is bounded above by an angular border of a narrow superior-external face, which widens posteriorly. The superior surface is an obtuse ridge. The internal surface is undivided by groove or ridge and slopes outward below. The inferior ridge terminates in an acumination at the inferior border of the cuboid facet. In front of the astragalar facets, the superior face of the calcaneum has three longitudinal fossæ separated by low ridges. The internal, which is in front of the sustentacular, is twice as large as any of the others. A transverse section through the middle of the cuboid bone is irregularly triangular. The external face is smooth. On the inferior face the large tuberosity is flattened, and is subquadrate in outline. It is separated from the edge of the metatarsal facet by a groove which is, however, *closed at both ends*, indicating that it has not a pulley-like function for the usual tendon. On the interosuperior face we have proximally a smooth band for the navicular, and about the middle, an oval facet transversely placed for the ectocuneïform. The cuboid and navicular do not then present in different directions as they do in Oxyæna, but in the same direction, as in Mesonyx.* The ectocuneïform is deeper than long, and longer

* Scott, On New and Little Known Creodonts, Jour. Phil. Acad., 1886, p. 163.

than wide. The cuboid facet is continuous, at a right angle with the navicular facet. The metatarsal facet is simple, and is anteroposteriorly concave. There are two distal mesocuneïform facets, and one proximal which is turned down for a short distance in front.

The *Dissacus navajovius* is a smaller species than any of the other Mesonychidæ, and is especially interesting in view of the ancestral characters which it displays. It shows that the specialization of the extremities which has occurred in the Carnivora has taken place in this line also, in the progressive digitigradism; the reduction of the digits; the development of a trochlea of the ankle-joint; and the loss of cusps from the molar teeth.

Measurements.	*M.*
Length of base of paradiapophysis of atlas	.016
" " odontoid process of axis	.009
" " atlantal facet of axis	.013
" " centrum of lumbar vertebræ	.018
Diameters glenoid cavity of scapula { anteroposterior	.020
Diameters glenoid cavity of scapula { transverse	.014
Transverse diameter condyles humerus in front	.017
Anteroposterior diameter of flange of do	.015
Length of olecranon	.028
Depth olecranon at middle	.015
" ulna at glenoid cavity	.013
" ulna at middle	.013
Diameters of head of radius { vertical	.0085
Diameters of head of radius { transverse	.015
Diameter of head of femur	.017
Diameters distal end of tibia { anteroposterior	.014
Diameters distal end of tibia { transverse	.017
Length of astragalus	.022
Greatest width of astragalus	.018
Diameters trochlea of astragalus { anteroposterior	.014
Diameters trochlea of astragalus { transverse	.011
Transverse diameter navicular facet do.	.018
" " cuboid " "	.002
Length of calcaneum	.042
" " tubercalcis	.025
Width calcaneum at sustentaculum	.0185
Diameters of cuboid facet { vertical	.0085
Diameters of cuboid facet { transverse	.013
Depth of calcaneum just behind cuboid facet	.013
Length of cuboid	.018
Distal diameters of cuboid { anteroposterior	.010
Distal diameters of cuboid { transverse	.010
Diameters of ectocuneïform { longitudinal in front	.008
Diameters of ectocuneïform { anteroposterior	.010
Diameters of ectocuneïform { transverse distally	.006

CONDYLARTHRA.

Among the specimens which represent this suborder, some display portions of the temporary dentition. I have already described this in Periptychus, but have had no light on that of the other genera.

A cranium and a separate set of jaws of *Haploconus corniculatus* display the last two temporary molars of the superior series. The third superior true molar is just protruding and the two temporary molars in question remain in place considerably worn. The last temporary molar is scarcely distinguishable in all its details from the permanent true molars. The penultimate deciduous premolar closely resembles in form and size the permanent first premolar, differing only in the presence of a small anterior basal cusplet. In a lower jaw of the *Anisonchus gillianus* the deciduous last inferior premolar is in place with the crown of its successor below it, and in front of the latter is the crown of the penultimate permanent molar. The penultimate deciduous molar is wanting. The last deciduous molar resembles in every respect the first true molar. We have now in this kind of dental succession a state of affairs similar to that which I have described in the creodont genus Triïsodon, and which is probably common to all Creodonta. The last deciduous molar in both jaws resembles exactly the true molars. Were this tooth not shed these animals would be like the Marsupialia in presenting the false appearance of four true molars.

I have shown that in Ectoconus the deciduous premolars iv and iii have the pattern of the permanent true molars (Tert. Vert., Pl. XXIX d, fig. 4). The corresponding inferior deciduous teeth are also like the true molars, the penultimate with the fifth cusp more anterior in position.

In the genus Protogonia I have observed that the last deciduous inferior premolar is rather more complex in its form than the first true molar. It possesses three distinct lobes arranged longitudinally, as in the Diplarthra, but the anterior lobe is not so well developed as in those animals. The specialization of this tooth has not progressed so far as it has in the Diplarthra, but a little more than in the Periptychidæ. This character may serve to distinguish the Phenacodontidæ from the Periptychidæ.

In Periptychus, as I have already shown, the last deciduous molar is more complex than the premolar which succeeds it, but is not quite so much so as a true molar. It has also a rudiment of the third lobe anteriorly, indicating a step beyond Haploconus in anteroposterior enlargement, while it is a step behind in transverse development. The three genera, considered together, display such a series of progressive modification of the last deciduous premolar, as to convince one of its possession of a

history of its own, and to confirm the Flowerian idea that the deciduous dentition is an addition to mammalian development, and not a survival of reptilian conditions. They also show that the proposition of the same author that the Marsupialia have four true molars is untenable, as I have previously claimed.

Fragments of skeletons of the smaller Periptychidæ are not rare in my collection. I have been unable so far to fix their species, and as they present no important differences from the corresponding parts of Periptychus, I do not now describe them.

The mandibular dentitions of the species of the smaller Periptychidæ are very much alike, and they are with difficulty distinguished one from another. I give the following table to facilitate their determination.

I. Anterior external cusp of true molars extended forwards, but not incurved.

a. Premolars elongate and compressed.

Molar series about .033 m..... *Haploconus xiphodon.*

aa. Premolars shorter, oval in longitudinal section.

Molars .025..... *H. angustus.*

" .032..... *H. lineatus.*

" .044..... *H. corniculatus.*

II. Anterior external cusp of true molars with anterior ridge directed inwards to a more or less developed fifth cusp.

a. Premolars robust, with wide section.

Premolars with oval section; true molars .016..... *H. entoconus.*

Premolars with oval section; true molars .009..... *H. cophater.*

Premolars nearly round in section; molars .019..... *Hemithlæus kowalevskianus.*

aa. Premolars narrower, with strong anterior cusp.

True molars .018..... *Anisonchus sectorius.*

True molars .014..... *Hemithlæus apiculatus.*

True molars .012..... *Anisonchus gillianus.*

True molars .011..... *A. agapetillus.*

aaa. Premolars much compressed and elongate.

True molars .040..... *A. mandibularis.*

The mandibular dentition of *Anisonchus coniferus* is not sufficiently well known to be introduced into the table.

HAPLOCONUS Cope.

Amer. Naturalist, 1882, p. 417; Tertiary Vertebrata, 1885, p. 415.

The penultimate and last superior milk molars of this genus have been described above, together with the inferior milk molars in the genus Anisonchus. It results from these observations that the peculiar form of last and penultimate inferior premolars which I have observed in the *Haploconus xiphodon* are permanent teeth, as I

have already supposed (Tertiary Vertebrata), and that the inferior dentition represented in my Plate XXV e, fig. 6, as the milk dentition of that species, is not such, but is the permanent dentition of the *H. lineatus*. The premolars in question are much worn, so that the absence of the last true molar is probably due to accident rather than to non-protrusion. A second specimen of the *H. xiphodon* confirms its characters.

Additional specimens of the *Anisonchus cophater* show that it is referable to this genus. This, with the new *H. corniculatus*, increases the species of Haploconus to six.

HAPLOCONUS CORNICULATUS Cope, sp. nov.

Five more or less complete crania and a set of jaws represent this species. Its characters are to be seen in its peculiar superior molar teeth, and in its superior size.

The species presents the general characters of the *H. lineatus*, especially as to the form of its first premolar, which has the internal cusp an elevated concentric cingulum, and its enamel vertically striated with shallow grooves. The anterior cingulum of the true molars however terminates at its interior extremity in an acute erect cusp which is wanting in the *H. lineatus*, and the cusp of the posterior cingulum is isolated by a notch of the latter, which develops a second lower cusp immediately posterior to the first mentioned. This second posterior cusp is seen on the posterior molar of the *H. lineatus*, but not on any of the others. The dimensions of the *H. corniculatus* are constantly superior to those of the *H. lineatus*, as the following measurements will show. The lengths on the superior molar series to the canine tooth, in three specimens of each species, are as follows:

H. corniculatus	.045	.043	.040
H. lineatus	.034	.033	.035

The skull is elongate and is narrow in the cerebral region. The sagittal crest is low, as is also the inion. The orbit is small and lateral. The canines are directed vertically downwards.

Measurements of Skull.	*M.*
Total length	.125
Length from occipital condyle to last molar	.058
Width between last molars, inclusive	.037
" " canines, inclusive	.026

The inferior dentition is similar to that of the *H. lineatus*, but is more robust.

HAPLOCONUS COPHATER Cope. *Anisonchus cophater* Cope; Proc. Amer. Philos. Soc., 1883, p. 321.

This species, described from a fragment of a mandibular ramus, is now represented by a large part of a second ramus supporting five teeth, and an anterior part

of a cranium with both series of superior molar teeth, lacking the anterior two premolar crowns. The only reason for associating the last specimen with the two others, is the identity in proportions and dimensions between them, and as the species differ widely in these respects from the others of the genus, the association is justified by our knowledge as far as it goes.

The dental characters of the upper series are a diminutive of those of the *H. entoconus*. The internal cusp of the first premolar is a well-developed cone. The fourth or posterior cingular cusp of the true molars is conic, and is almost on the inner side of the third. The anterior cingulum is distinct and reaches the fourth tubercle. The external cingulum of the true molars is very strong, but is reduced to a trace on the first and second premolars. The second external cusp of the last true molar is very rudimental, so that that tooth is narrower than the others, and than in the *H. lineatus*. There is a ledge at the anterior base of the first premolar.

The infraorbital foramen issues above the posterior border of the anterior root of the second premolar. The zygomatic ridge of the maxillary originates above the middle of the first true molar. The nasal bones are elongate.

In the mandibular dentition the first premolar is larger than any of the true molars, and has a well-developed heel. Its section is nearly a half circle in outline, the external face being convex. The true molars have a cingulum on the anterior half of the crown; the premolars none at all.

Measurements.		*M.*
Length of superior dental series (p. m. iv, estimated)		.024
" " true molars		.008
Diameters p. m. i	anteroposterior	.003
	transverse	.005
Diameters m. ii	anteroposterior	.0025
	transverse	.006
Width between p. m. ii		.010
" " m. iii		.009
Length posterior four inferior molars		.013
Diameters p. m. i	anteroposterior	.0042
	transverse	.0025
Diameters m. i	anteroposterior	.0034
	transverse	.0022
Depth of ramus at m. i		.011

This, with the *Anisonchus agapetillus*, is the smallest species of the Condylarthra. It will not be certain until the superior dentition of the latter is discovered, whether it belongs to this genus or the one in which I have provisionally placed it.

ANISONCHUS Cope.

Proc. Amer. Phil. Soc., 1881, p. 488; Tertiary Vertebrata, 1885, p. 408.

ANISONCHUS MANDIBULARIS Cope; Amer. Naturalist, 1881, p. 831. *Mioclænus mandibularis* Cope; Tertiary Vertebrata, 1885, p. 339.

The discovery of a second specimen of this species, which includes nearly all of the dentition of both jaws, proves that the position I originally assigned it is the correct one. The second superior premolar is like the first in having an internal cusp, whose base is, like that of the *A. sectorius*, concentric with the principal cusp of the crown.

The great peculiarity of the species, which is displayed by all the specimens, is the relatively large size of the second inferior premolar. It exceeds the first in anteroposterior extent, which is in turn longer than any of the true molars. The third premolar is also shorter than the second. The fourth premolar and canine are not preserved. The fifth cusp is well developed on the first and second true molars, but is of reduced proportions on the third. The heel supports the two lateral and smaller median cusps usual in this group. On the third molar the laterals are compressed and the median has a posterior position.

In the superior true molars the second exterior cusp of the third is well developed. The fourth cusp is situated well inwards, further than in *A. sectorius*, but not so far as in *A. coniferus*. There is a short anterior cingulum, which disappears before reaching the internal angle of the crown. External cingulum distinct. The second premolar is as large as the first, and both have a small anterior basal tubercle. Enamel surface smooth. Third premolar of reduced diameters.

Measurements.		*M.*
Length of six superior molars		.036
" " true molar series		.016
Diameters p. m. ii	anteroposterior	.0065
	transverse	.007
Diameters m. ii	anteroposterior	.006
	transverse	.0075
Length of posterior five inferior molars		.029
" " inferior true molars		.016
Diameters p. m. ii	anteroposterior	.008
	transverse	.0035
Length of p. m. i		.005
Diameters m. i	anteroposterior	.005
	transverse	.0042

HEMITHLÆUS Cope.

Amer. Naturalist, 1882, p. 832.

But two species of this genus are known to me, one of which has not been described. This is the *H. apiculatus*, and it shows such strong tendencies to Anisonchus that it is possible that the two genera will have to be combined. Both species of Hemithlæus have an internal cusp on the second superior premolar, as in Anisonchus. The position of the *A. baldwini* remains uncertain.

Fig. 11.

Fig. 12.

Fig. 11. *Hemithlæus kowalevskianus*, last five superior molars, $\frac{2}{3}$ natural size. Fig. 12. *Protogonia puercensis*, superior dentition, less fourth premolar, $\frac{2}{3}$ natural size.

Hemithlæus apiculatus Cope. *Anisonchus apiculatus* Cope; Tertiary Vertebrata, 1885, Pl. XXV e, fig. 7.

The mandibles of this species have been in my possession for a considerable time, and I have regarded them as indicating a small variety of the *Anisonchus sectorius*. But the discovery of the superior dental series shows that the species is quite distinct, and belongs between that animal and the *Hemithlæus kowalevskianus* in its characters.

As in the type of Hemithlæus there are an anterior and a posterior cingula of the superior molars. The posterior cingulum is produced a little further inwards than the anterior, but on the first true molar its border does not project further inwards than the internal angle of the crown. In the second molar it projects a little further, while in the third it projects so distinctly beyond the third cusp as to resemble the condition seen in Anisonchus. The anterior edge of the cingulum does not form a cusp, however, in either tooth, and for this reason I retain the species in the genus Hemithlæus. External cingulum distinct. The internal cusps of the first and second premolars are intermediate in form between the concentric type of *A. sectorius* and the conic form of *A. coniferus*. The transverse diameter of the first premolar is a little greater than that of a true molar, while the crown of the third premolar is subtriangular in section. The infraorbital foramen issues above the second premolar.

In the inferior true molars the fifth cusp is present, and is connected by ridge with

the external anterior. The opposite cusps of the heel are well developed, but the posterior median is quite rudimental. The first and second premolars are larger than the molars, but not disproportionately so, and they have a characteristic form. The crown is wide at the principal cusp, but the heel is small and is at the inner side of its posterior face. There is an anterior cusp which is a little to the inner side of the middle line of the principal cusp, and which is distinct at a point much above the base of the crown, being marked off from the main cusp below by a shallow groove. A line passing through the long axis of the crown is an open sigmoid. The last true molar rises on the base of the coronoid process. Both the external side of the ramus and its inferior margin are gently convex. The anterior border of the masseteric fossa is distinct, but there is no inferior border.

Measurements.		*M.*
Length of superior molars except p. m. iv		.025
Length of true molars		.0112
Diameters of p. m. iv	anteroposterior	.004
	transverse	.0065
Diameters of m. ii	anteroposterior	.0035
	transverse	.007
Length inferior molars less p. m. iv and iii		.023
Length true molars		.0125
Diameters of p. m. i	anteroposterior	.0048
	transverse	.0036
Diameters of m. ii	anteroposterior	.0045
	transverse	.0038
Depth of ramus at m. i		.010
" " " " m. ii (posteriorly)		.012

Jaws of eight individuals of this species have come into my possession.

HEMITHLÆUS KOWALEVSKIANUS Cope ; Amer. Naturalist, 1882, p. 832 ; Tertiary Vertebrata, 1885, p. 405.

A crushed cranium of this species shows some points previously unknown. The sagittal crest is low and divides into the temporal crests, which diverge widely and rapidly to the postorbital angles. These are distinct, but not produced. The orbits are small, and have a partially upward direction. The infraorbital foramen opens above the anterior border of the second premolar. The latter tooth has a well-developed internal cusp. The palate is wide, but as the skull has been crushed this width is probably exaggerated.

In the inferior dentition this species may be readily distinguished by the very robust first and second premolars which are shorter and wider than in any other.

PERIPTYCHUS Cope.

Amer. Naturalist, 1881, p. 337; Tertiary Vertebrata, 1885, p. 387.

PERIPTYCHUS COARCTATUS Cope; Tertiary Vertebrata, Pl. XXIX d, explanation, and figs. 7-8; Amer. Naturalist, 1884, p. 801, fig. 10.

This, with the *P. brabensis*, is characteristic of the lower beds of the Puerco, as the *P. rhabdodon* is of the upper beds. It is not so abundant as either of the others, only five individuals having come into my possession.

This species is of smaller size than the *P. rhabdodon* and the *P. carinidens*, and is especially distinguished from both, in that the cingulum of the inferior premolars is not continuous on the inner side of the crown, but is confined to the anterior and posterior bases, sometimes to the posterior base exclusively. The first and second premolars are larger than the true molars, and the latter diminish in size posteriorly. In the inferior molars the fifth cusp is present, and as in the premolars there are traces of external cingula. The grooved striation of the crowns is distinct. The characters which distinguish the species from the *P. brabensis* are the following. The transverse diameter of the superior premolars is relatively much greater than in the *P. rhabdodon* and *P. brabensis*, and the true molars have a transversely compressed form. There is a faint cingulum on the external base of the true molars and first premolar in both jaws, at which the grooves of the enamel terminate abruptly. This is wanting in the *P. brabensis.* The external faces of the superior premolars are directed obliquely forwards and inwards, a character not seen in the *P. brabensis.*

Measurements of Superior Molars.		*M.*
Diameters p. m. i	anteroposterior	.011
	transverse	.016
Diameters p. m. ii	anteroposterior	.011
	transverse	.016
Diameters m. ii	anteroposterior	.0095
	transverse	.013

PERIPTYCHUS BRABENSIS sp. nov.

Twenty individuals represent this species in my collections, nearly all of them consisting of jaws only. Of these four only present the dentition of both jaws; one exhibits nearly the entire dentition of both maxillary bones, and one the last temporary molar of the lower jaw.

This species is still smaller than the *P. coarctatus*, and differs from it in the same way, *i. e.*, in the non-continuation of the cingulum across the interior side of the inferior premolars. But it differs from the *P. coarctatus*, as already

pointed out, in the smaller transverse diameter of the premolars, especially of the superior series, and in the absence of cingula on the external side of the premolars in both jaws. The inferior true molars also possess but traces of the cingula. The internal cingulum of the superior premolars is extensive, continuing round to the front and nearly to the external base of the first premolar. In the inferior premolars there is a short posterior heel, and on the first, a short anterior cingulum, which is however not always present. The infraorbital foramen issues above the front of the first premolar.

Measurements. No. 1 type.		*M.*
Length of p. m. i, m. i, and m. ii, superior		.029
Diameters p. m. i	anteroposterior, superior	.011
	transverse, "	.013
Diameters p. m. ii, inferior	anteroposterior	.012
	transverse	.008
Superior Molars, No. 2.		
Length of molar series		.070
" " true molars		.029
Diameters m. i	anteroposterior	.010
	transverse	.011
Diameters m. ii	anteroposterior	.098
	transverse	.013
Inferior Molars, No. 3.		
Length of last five molars		.050
Diameters p. m. i	anteroposterior	.0115
	transverse	.0095
Diameters of m. ii	anteroposterior	.008
	transverse	.008
Diameters of m. iii	anteroposterior	.0088
	transverse	.007

From the Lower Puerco only. D. Baldwin.

ECTOCONUS Cope.

Amer. Naturalist, 1884, p. 795; Tertiary Vertebrata, 1885, Pl. XXXV.

But one species, the *E. ditrigonus* Cope, is known. Excepting the brief notes contained in the above-mentioned publications the general characters of both genus and species remain undescribed.

In the superior dentition the first, second and third premolars possess one external and one internal cusps. In the inferior series the first and second have an internal cusp and a heel. The coracoid process is a robust recurved tuberosity. The astragalus is slightly convex anteroposteriorly, and slightly concave transversely. The

trochlea is not oblique to the axes of the bone. The head presents convex faces anteriorly interiorly. The anterior face is convex in every direction, and is continued to the external side. The internal face is not separated from the anterior along the superior border, but is separated below and distally by a strong notch. This interior facet indicates a large tibiale or "internal navicular," a bone well known in Rodentia, and in Bathmodon among the Coryphodontidæ. This facet is larger than in Periptychus, and in the latter genus it is not cut off by a groove as in Ectoconus. The calcaneum has a very long tuber. The astragaline facets are in a general horizontal plane, the internal (sustentaculum) small and a little concave; the external large, wide, and a little convex. No distinct fibular facet. The cuboid facet is large, and nearly anterior in presentation. The cuboid has the usual tuberosity, and also a large distal facet.

The foot was evidently entirely plantigrade and pentadactyle in this genus.

In its dentition Ectoconus presents the most complex known form of the tritubercular type.

ECTOCONUS DITRIGONUS Cope; Amer. Naturalist, 1884, p. 796, fig. 4. *Periptychus ditrigonus* Cope; Tertiary Vertebrata, p. 404, Pl. XXIII g, fig. 12. *Conoryctes ditrigonus* Cope; Tertiary Vertebrata, 1885, Pl. XXIX d, explanation, and figs. 2–6.

Thirty-two individuals of this species have been sent me, all from the Lower Puerco beds. The most important of these include the teeth and all the dentigerous bones, excepting the premaxillaries, with fragments of humerus, scapula and tibia with calcaneum, astragalus and cuboid elements entire. Of another, the proximal parts of the astragalus and calcaneum are preserved with the heads of the first, a median, and the fifth metatarsals.

The dentition has been described so far as the molars and superior incisors are concerned. The first and second true molars usually possess eight cusps, but occasionally there are nine, that is two external cingular cusps. The heels of the first and second inferior premolars are tubercular, and the external cingulum of the inferior true molars is well marked. The enamel is nearly smooth.

The external (fibula) side of the astragalus is a vertical facet. The internal face is nearly vertical. Beyond it a large depressed tuberosity projects a short distance inwards but not posteriorly. It bounds the sustentacular facet of the astragalus behind. This postsustentacular tuberosity is truncated inwards and downwards posteriorly. The sustentacular process of the calcaneum projects outwards and forwards in a subcircular rim beyond the smaller subround facet. The external facet forms about one-fifth of a circular band, the concavity being next the middle of the proxi-

mal end of the bone. Between it and the sustentacular facet is a ligamentous fossa In front of it the superior surface descends into a deep transverse notch which receives a descending angular process of the astragalus which is broken from my specimens. In other words the superior border of the cuboid facet rises upwards abruptly in front of this depression. This facet is quite large and narrows to an apex inwards, where it terminates at a small vertical tuberosity. Inferior to this apex is a subtriangular fossa, which is bounded externally by another tuberosity. A large longitudinal tuberosity supports the external border of the cuboid facet on the inferior side.

The skull fragments show that this species differed from all of the known Periptychidæ in having a very high and robust sagittal crest.

Three vertebræ of the specimen described are preserved, the axis, a lumbar and two caudals; all without arches. The axis is about as long as the lumbar, omitting the odontoid process. The latter is rather short and is depressed, the section being a transverse oval. Its articular surface is continuous with the atlantal facets. Body with a median inferior keel. The lumbar is short, but exceeds the axis in transverse diameter. The articular faces are subplane, while the sides of the centrum are concave, and not keeled at any point. Two strong foramina perforate the floor of the neural canal. The bodies of the caudals are depressed and a little longer than wide. One of them has a median keel-angle below. Other specimens show more distal caudals of elongate form, showing that this species had a long tail like the *Phenacodus primævus.*

Measurements of sp. No. 1.		*M.*
Length of superior true molars with p. m. i and ii		.044
Diameters of p. m. iv	anteroposterior	.007
	transverse	.011
Diameters m. i	anteroposterior	.010
	transverse	.013
Diameters m. ii	anteroposterior	.010
	transverse	.013
Diameters m. iii	anteroposterior	.009
	transverse	.012
Length inferior dental series including canine		.073
Diameters base of canine	anteroposterior	.008
	transverse	.0085
Length of true molars		.034
Diameters p.m. i	anteroposterior	.008
	transverse	.0085
Diameters m. ii	anteroposterior	.0105
	transverse	.010
Diameters m. iii	anteroposterior	.012
	transverse	.009

Measurements of sp. No. 1.	M.
Depth of ramus at p. m. iii	.021
" " " m. i	.025
Diameter axis: anteroposterior, total	.030
Diameter axis: transverse, greatest	.032
Length of odontoid process to atlantal facet	.009
Diameters lumbar centrum: anteroposterior	.020
Diameters lumbar centrum: articular face: transverse	.030
Diameters lumbar centrum: articular face: vertical	.021
Diameters proximal caudal centrum: anteroposterior	.021
Diameters proximal caudal centrum: articular: transverse	.016
Diameters proximal caudal centrum: articular: vertical	.015
Widths of scapula proximally: anteroposterior, total	.041
Widths of scapula proximally: " glenoid cavity	.029
Widths of scapula proximally: " neck	.033
Widths of scapula proximally: transverse, glenoid cavity	.019
Diameters distal end of tibia: anteroposterior*	.022
Diameters distal end of tibia: transverse	.025
Greatest length of astragalus	.035
" width " "	.026
Diameters of trochlea: anteroposterior	.021
Diameters of trochlea: transverse	.018
Length of calcaneum	.058
Width proximally (transversely measured)	.038
Transverse extent of sustentaculum	.014
Transverse diameter of cuboid facet	.018
Length of cuboid	.019
Transverse diameter of distal facet do.	.019
Vertical " " " "	.011

Specimen No. 2.	
Diameters peduncle of ilium: anteroposterior	.025
Diameters peduncle of ilium: transverse	.022
Width of internal side of peduncle of ilium	.020
Diameters of acetabulum: anteroposterior	.028
Diameters of acetabulum: vertical	.028
Greatest diameter of peduncle of pubis	.011
Diameters of ischium at spine: anteroposterior	.027
Diameters of ischium at spine: transverse	.009
Estimated length of femur	.140
Width do. at condyles	.045
Anteroposterior diameter do. at rotular crests	.042

The pelvis has large obturator foramina. The ilium is rather short and robust, and it has a wide anterior face to the crest, but this is not so wide as the interior face, except at the peduncle, where it is wider. The anterior inferior spine is a vertical oval tuberosity a centimeter above the acetabulum. The latter has a wide ligament-

* A small posterior tuberosity estimated for.

ous fossa at the fundus, and the usual ischiadic notch and groove. The pubis is slender. The ischium is flat, and the tuberosity is a convexity of the posterior edge which terminates in a little angular contraction, forming a "spine."

The fossa ligamenti teris of the femur is a fissure which runs out to the margin of the head. The trochanters are large; the third moderately prominent, and partly opposite to the lesser trochanter. The rotular groove is wide and elevated, and its borders are equal. The external condyle is narrower than the internal. On the whole the femur is a good deal like that of the *Periptychus rhabdodon.*

PROTOGONIA Cope.

Proc. Amer. Phil. Soc., 1881, p. 492; Tertiary Vertebrata, 1885, p. 424. *Phenacodus* pt. Cope; loc. cit., 1881, p. 492; 1885, p. 488.

This genus was originally distinguished from Phenacodus by the presence of but one external tubercle on the first superior premolar, since there are two in Phenacodus. Additional specimens show that the second external tubercle of the *P. puercensis* is normally rudimental, so that that species may be properly referred to Protogonia. It is further distinguished from Phenacodus by the presence of but one external cusp on the second superior premolar, in which it agrees again with the species referred to Protogonia. The latter genus thus defined embraces five species which differ as follows:

I. Fifth cusp present on inferior true molars.

Last four inferior molars, .025; internal cusp on inferior p. m. i, rudimental.....*P. zuniensis.*

Last four inferior molars, .030; internal cusp of inferior p. m. i, large.....*P. plicifera.*

II. Fifth cusp wanting from inferior molars, except sometimes m. i.

First superior premolar with rudimental second external cusp; inferior true molars, .026; last robust premolars with no, or tubercular heels.....*P. puercensis.*

Inferior true molars, .026; last small; premolars with wide, flat, smooth heels.....*P. calceolata.*

As may be seen from the catalogue of species, the material representing this genus is quite abundant. This is true only of jaws and teeth, for identifiable parts of skeletons are yet very rare. A very much damaged cranium of the *P. puercensis* displays nearly all the dentition, the incisors and the fourth premolar being absent. The first and second premolars only have internal cusps. In the superior canines the vertical direction is the same as is seen in Haploconus sp.

The fifth cusp is wanting from the last inferior true molar in the *P. plicifera,* and is in a few specimens absent from the second also. Specific difference cannot be predicated on the presence or absence of this cusp, although in more specialized types, its variations are of generic importance. The premolars of the lower series are spaced in the *P. plicifera,* while they are in close succession in the *P. puercensis.*

AMBLYPODA.

PANTOLAMBDA Cope.

Amer. Naturalist, 1882, p. 418; Tertiary Vertebrata, 1885, p. 601.

Additional material belonging to the two known species of this genus, throw light on points of structure hitherto unknown.

As regards the dentition, the superior premolars are identical with those of Coryphodon.

In the anterior foot the cuneïform has the general character of that of Coryphodon. The pisiform facet is wider, thus approaching the unguiculate types of the same epoch.

In the posterior foot the cuboid of the *P. cavirictus* differs from that of any of the Coryphodontidæ which I have seen in the greater mutual obliquity of the two proximal facets. That for the astragalus is a wide concave fossa; that for the calcaneum is a hook-shaped band, the convexity proximad, and the longer arm, or stem, of the hook anterior, and the shorter posterior to a ligamentous fossa. The anterior band-like facet turns transversely distally. The position of the cuboid is oblique in the foot, giving the digits which arise from it a divergent direction externally. The astragalus of this species closely resembles that of *P. bathmodon*. The ectocuneïform is much like that of Coryphodon, but is not so depressed, the anterior face being square. The mesocuneïform has only two-thirds the longitudinal depth in front. The entocuneïform is narrower transversely than in Coryphodon, and approaches the form of some of the unguiculates. It indicates a smaller internal digit than in Coryphodon. The above-described bones all belong to one individual.

EXPLANATION OF PLATES.

PLATE IV.

Hemiganus otariidens Cope, natural size.

Fig. 1. Part of maxillary bone displaying canine and two premolar teeth, with ? lachrymal foramen at *a*; and with part of premaxillary bone.

Fig. 2. Left ramus of mandible from left side. The ? canine was found separate, and is drawn in; *a*, same from above, canine omitted.

Fig. 3. Parts of pariëtal and frontal bones from above; *a*, temporal ridge.

Fig. 4. Right frontal and part of pariëtal bone, the sutural surface showing olfactory fossæ on inferior face.

Fig. 5. Left inferior ? canine tooth represented in fig. 2, from front; *a*, from behind.

Fig. 6. Inferior premolar tooth free from alveolus, from front; *a*, from inner side; *b*, from above.

Fig. 7. First inferior molar of right side, external view.

Fig. 8. Atlas, left half, from left side; *a*, from behind.

Fig. 9. Axis from above; *a*, from right side.

Fig. 10. Cervical vertebra without epiphyses; *a*, from below.

Figs. 11–12. Cervical vertebræ; *a*, from below.

T. SINCLAIR & SON, LITH. PHILA.

HEMIGANUS OTARIIDENS COPE ¼

1-7. HEMIGANUS OTARIIDENS ½. 8-9 ONYCHODECTES TISONENSIS

10-11. HEOPLACAULAX MOLESTUS ½.

PLATE V.

Figs. 1–6. *Hemiganus otariidens*, parts of specimen figured on preceding plate, natural size.

Fig. 1. Ulna of right side, from within ; *a*, from above.

Fig. 2. Proximal extremity of radius from below ; *a*, proximal view.

Fig. 3. Left femur, proximal half, from behind ; *a*, external view.

Fig. 4. Distal half of right tibia, from front ; *a*, from external side ; *b*, distal extremity.

Fig. 5. Metacarpus of pollex, externoanterior view ; *a*, internal view ; *b*, edge view.

Fig. 6. Metapodial, from side ; *a*, from front ; *b*, from behind.

Fig. 7. Ungual phalange, side view ; *a*, proximal extremity ; *b*, from above ; *c*, from below.

Fig. 8. *Onychodectes tisonensis* Cope ; maxillary bone of right side, with four molars, from below, $\frac{3}{2}$ natural size ; typical specimen ; *a*, the same from the palatal side.

Fig. 9. Left mandibular ramus of the same species, natural size, broken, external side ; *a*, crown of second true

ADDENDUM.

On page 311 it is stated that in the genus Hemiganus "there are probably but two true molars." Further cleaning of the specimen shows that there are three true molars, as represented in Plate IV, fig. 2 a.

ARTICLE VI.

ON THE SHOULDER-GIRDLE AND EXTREMITIES OF ERYOPS.

BY E. D. COPE.

Read before the American Philosophical Society, January 20, 1888.

Our knowledge of the genus Eryops, which is one of the most abundant types of the Rhachitomous Batrachia, extends to the skull in general, the vertebral column, the pelvis, humerus, femur, and tibia.* The shoulder-girdle, fore foot, and hind foot are unknown, although the hind foot of a species from the coal measures provisionally referred to this genus has been described.† In the present paper I can describe the missing parts from a skeleton found with skull of the *Eryops megacephalus*, which was obtained in Texas, in the Permian beds, by that indefatigable and skillful collector, Jacob Boll.

The shoulder-girdle embraces scapula, coracoid, præcoracoid, clavicle, and episternum. The scapula is flat and elongate; its superior portion is rather thin, and gradually expanded and rounded like the end of a boat's oar. Below it passes directly into the coracoid and præcoracoid, the suture becoming obliterated early. The præcoracoid is larger than the coracoid, is convex downwards, while the coracoid is convex upwards. This leaves a fossa at their line of junction on both surfaces, and through this the coracoid foramen is pierced. The posterior border of the coracoid is regularly convex, and is not notched as in the Pelycosaurian Theromora.‡ The internal and anterior border of the præcoracoid form a continuum of convex outline, the former passing rather abruptly into the latter. The clavicles are curved bones, forming, as usual, the anterior border of the shoulder-girdle. Their superior portion is directed upwards and

* Proc. Amer. Philos. Soc., 1880, p. 52.

† Trans. Amer. Philos. Soc., 1886, p. 289.

‡ Theromora is substituted for Theromorpha, a name which had been previously used.

backwards, in the form of a band, and it does not extend so far on the scapula as is usual with Reptilia, and terminates in a rather abrupt flat apex. The inferior portion becomes horizontal and is directed forwards at an open angle, meeting its fellow on the middle line. This portion expands a little, presenting a thin edge posteriorly, and an oblique truncation inwards and forwards with grooved and finely digitate edge, at the distal end. The clavicles underlap the episternum. The latter is a flat discoidal bone rather wider than long, with a regularly convex, thin posterior edge. The lateral portions are overlapped by the præcoracoids. The anterior border is coarsely toothed, as though for the attachment of an omosternum. Of true sternum I do not observe any trace of sternum.

The differences between the shoulder-girdles of Eryops and of Actinodon (Gaudry) are considerable. The latter has been described and figured by Professor Gaudry, and I have had, through his kindness, the opportunity of examining the typical specimen. An obvious difference is that the latter genus, as in many Stegocephali, has the episternum and proximal parts of the clavicles sculptured on the inferior (external) face, with exostosis, which occupies the true skin. The clavicle articulates externally with a slender bone, which is regarded by Gaudry as clavicle. It occupies the position of the anterior thickened portion of the scapula in Eryops. What its true homology is is not clear to me, but it is in the position of the epiclavicle of the fishes. The scapula is coössified with the præcoracoid. The true coracoid is very small, less even than in Eryops. An easily observed peculiarity of Actinodon is that the episternum is longitudinal diamond-shaped, as in Stegocephali generally.

The shoulder-girdle of Cricotus is in my collection, but is so difficult to extricate from the matrix that its characters are not all clear. The clavicles are expanded inwards over the edges of the episternum as in Actinodon, and more widely than in Eryops, and the expanded surface is sculptured as in that genus. The slender part of the clavicle is strongly curved upwards, as in Actinodon. The episternum is also produced posteriorly as in Actinodon.

As compared with the Pelycosaurian reptiles, the shoulder-girdle of Eryops and its allies shows several important points of resemblance, some of which I have already described. Such are the small coracoid and large præcoracoid, both coössified with the scapula in adults. The episternum in Dimetrodon at least, differs in its long narrow posterior prolongation, as in Lacertilia.* The clavicles have not been described in Clepsydropidæ, although they have been in Diadectidæ.† In the latter the clavi-

* Transactions Amer. Phil. Soc., 1886, p. 292, Pl. III, fig. 5, where I inadvertently called it sternum.

† Proc. Amer. Phil. Soc., 1888, p. 635.

cles are narrow, and expand but little at their contact with the episternum. They form a symphysis behind and below the episternum, which has an exclusively anterior and superior exposure. The latter is wedge-shaped in longitudinal section, thinning out rapidly posteriorly, where it is not produced on the middle line as in the Clepsydropidæ.

In Dimetrodon the form of the clavicle is similar to that of Cricotus. That is the inferior portion is bent inwards at right angles to the vertical portion, and is greatly expanded in the anterior direction. Its inner margin is finely digitate by the production of numerous radiating ridges. This portion of the shoulder-girdle projects forwards in the manner of the so-called epiplastral bone of the plastron of the Testudinata. With the episternum in place this part of the shoulder-girdle of Dimetrodon resembles the anterior lobe of the plastron of a tortoise. A narrowing of the præcoracoid and scapula, and an elongation of the coracoid, would give the Testudinate shoulder-girdle. Such a change in some unknown member of the Theromorous order, together with modifications of the abdominal costoïds, has given origin to the order Testudinata.

The anterior leg of Eryops is short, and very robust. The anterior foot has the character, entirely exceptional in the Batrachia, of having five digits. The humerus has been already partially described.* It resembles very nearly that described by Professor Gaudry to his *Euchirosaurus rochei*.† It is short and very robust, and the extremities are greatly expanded and almost at right angles to each other. The proximal extremity with its band-like articular surface, is strongly decurved anteroexteriorly, ending in a strong protuberance. The distal end has an enormous plate-like expansion of the internal epicondyle, greater than that exhibited by *Euchirosaurus rochei*. The condyle is subglobular and large, and the external epicondyle is partly posterior to it. This epicondyle forms a process flattened on the posterior face, which is continued upwards into the shaft of the humerus, and is bounded below by a semicircular sharp edge. On the external border of the shaft above the notch between the condyle and the external epicondyle, is a short, obtuse, vertically compressed process directed at right angles to the shaft. A similar process exists in *Euchirosaurus rochei* (Gaudry).

The ulna has little or no olecranon, and has a strong glenoid cavity on the superior aspect for the condyle of the humerus. It resembles much that of a pelycosaurian. The shaft is slender, and the distal extremity is not expanded. At the latter place the superior face is flat, and the inferior is convex. The radius is a short

* Proc. Amer. Phil. Soc., 1880, p. 54.

† Enchainements du Monde Animal; Fossiles primaires, 1883, p. 277.

robust element, with both extremities expanded, the distal much more so than the proximal. The latter is truncated, with a wide oval outline, and rests, as in land vertebrates generally, on the coronoid process of the ulna. The shaft is suboval in section, and is much stouter than that of the ulna. The distal end is convex and is horizontally expanded so as to rest on three carpal elements: radiale, centrale 1, and intermedium. Its inferior face is flat distally, and the distal outline is openly angulate with subequal faces; one principally for the radiale, and the other principally for the intermedium.

The carpus consists of ten, possibly of eleven elements. Four of these are in the proximal row, viz., radiale, centrale, intermedium and ulnare. The second row consists of five carpalia. Between the two rows is centrale 2, which appears to have a small centrale 3 separated from its external end, but on the palmar face, the distinction is not clear. The carpals are, in the order of size, as follows: ulnare, centrale 1, centrale 2, radiale, carpale 5, intermedium, carpale 2, carpalia 1, 4 and 3. The metacarpals are flattened, with the extremities truncate and expanded; the proximal the wider; the distal without indication of condyles. The third and fourth are twice as long as wide distally, and the first is as wide as long. The fourth digit is the only one in the specimen in which the phalanges are preserved. There are three of them, the ungual very small and subconic in form, the inferior face flatter than the superior. The two other phalanges are about as wide as long.

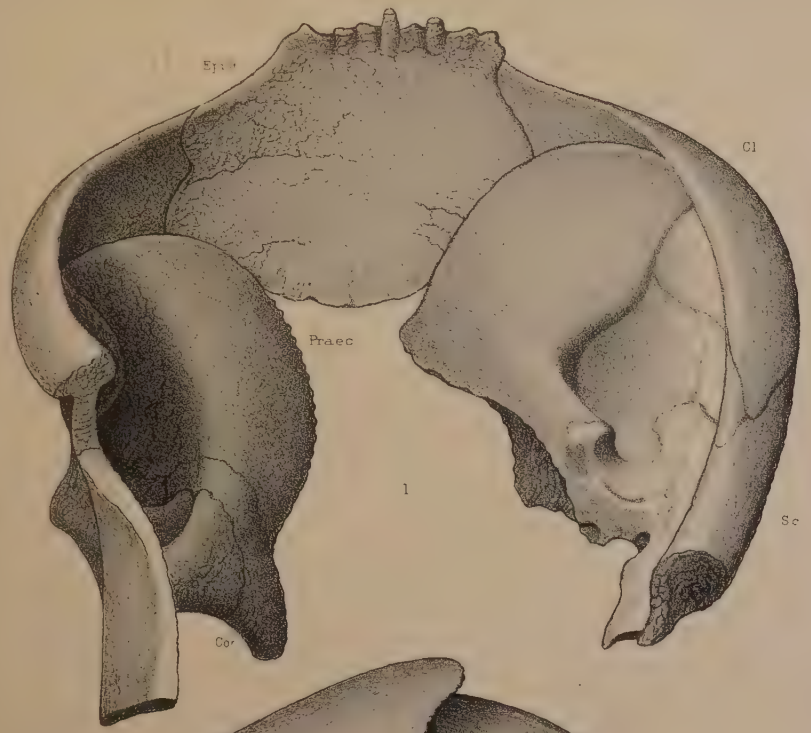
Measurements.	*MM.*
I. Shoulder-girdle.	
Width at anterior border of præcoracoid	235
Diameters episternum, anteroposterior	110
Diameters episternum, transverse	130
Greatest (inferior) width of clavicle	70
Length of coracopræcoracoid on upper surface	160
II. Anterior leg.	
Humerus, greatest width proximally	90
" " " medially	40
" " " distally	103
" " length (part estimated)	120
Ulna, length	112
Ulna, transverse diameter proximally	45
Ulna, transverse diameter medially	15
Ulna, transverse diameter distally	30
Radius, length	78
Radius, transverse diameter proximally	42
Radius, transverse diameter medially	27
Radius, transverse diameter distally	60
Length of carpus from ulna to m. iv.	62
Width of carpus, proximal row	95
Length of fourth digit	78

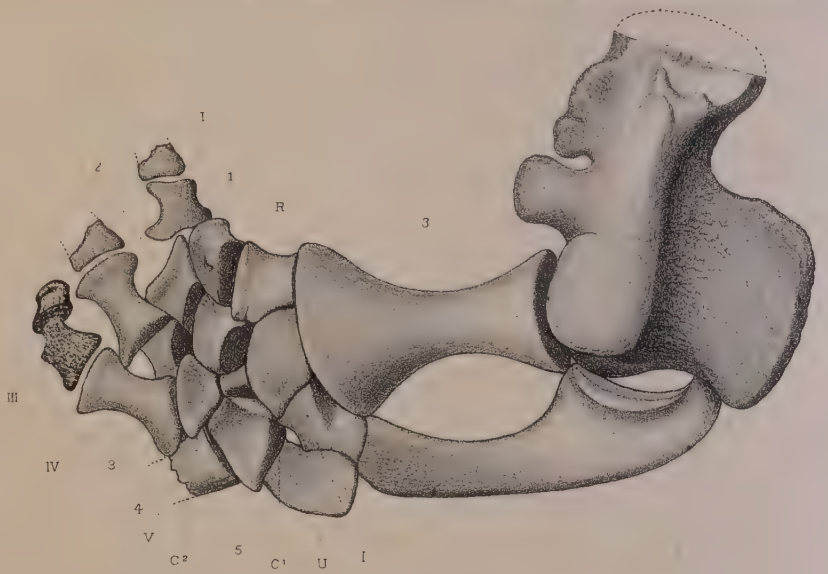
This carpus and fore foot is noteworthy from the presence of five digits, an unusual character in the class Batrachia. The genus Archegosaurus has but four, although according to Baur* there are five carpalia. In the presence of two centralia, Eryops agrees with occasional specimens of both *Cryptobranchus allegheniensis* and *Megalobatrachus japonicus* (Wiedersheim). If three centralia are present, the resemblance to *Archegosaurus decheni* is greater, where, according to Baur, there are four.

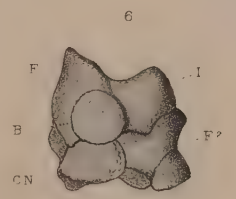
The posterior foot found at the same time and place as, and having appropriate proportions to, the parts already described, is not so well preserved. The distal elements of the leg have subequal widths, but they are folded back to back so that one of them has lost its tarsal connections. One of them, perhaps the tibia, remains articulated to two proximal tarsals, probably tibiale and intermedium. The approximated surfaces of these bones are very thick, as is the internal face of the tibiale. The external face of the intermedium is, on the contrary, thinned out. The tibiale is characterized by the presence of a round, flat, discoid tuberosity on its ? posterior face, which resembles the disc of a button. Distad from the tibiale is a large transverse centrale, in the position of the Pelycosaurian and Mammalian navicular. It articulates with the distal extremities of the intermedium as well. Its distal face articulates with two tarsalia, which are somewhat displaced in the specimen. The remainder of the foot is in two separate pieces, which represent probably parts of both posterior feet. In one of these I count five metatarsal bones very much displaced. Two of them are of rather small size. In the other block is a series of four consecutive phalanges, all wider than long. The distal one is quite small, but the ungual is not present.

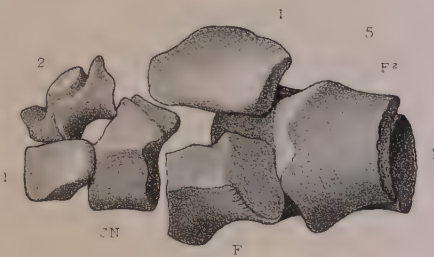
Two small tarsi from opposite sides of perhaps the same individual were found mixed with the bones of the larger animal. They belong to an allied form. The tibiale has the same button-like disc on one of its faces, and it articulates distally with a navicular-centrale. The ? intermedium is a shorter bone and unites with a single element, which may represent a centrale 2, or a cuboid. It *appears* to articulate distally with two elements, though the matrix does not let it be determined whether the lines observed are sutures or fractures. And it is not certain whether the two supposed elements are tarsalia or proximal ends of metatarsalia. There is, as in the larger tarsus, no indication of an exterior or fibular series of tarsals. The bone referred to as possibly cuboid, rises on the external side of the level of the proximal face of the intermedium, and may be therefore a fibulare, which presents very little proximal facet. This tarsus strongly suggests the presence of but four digits.

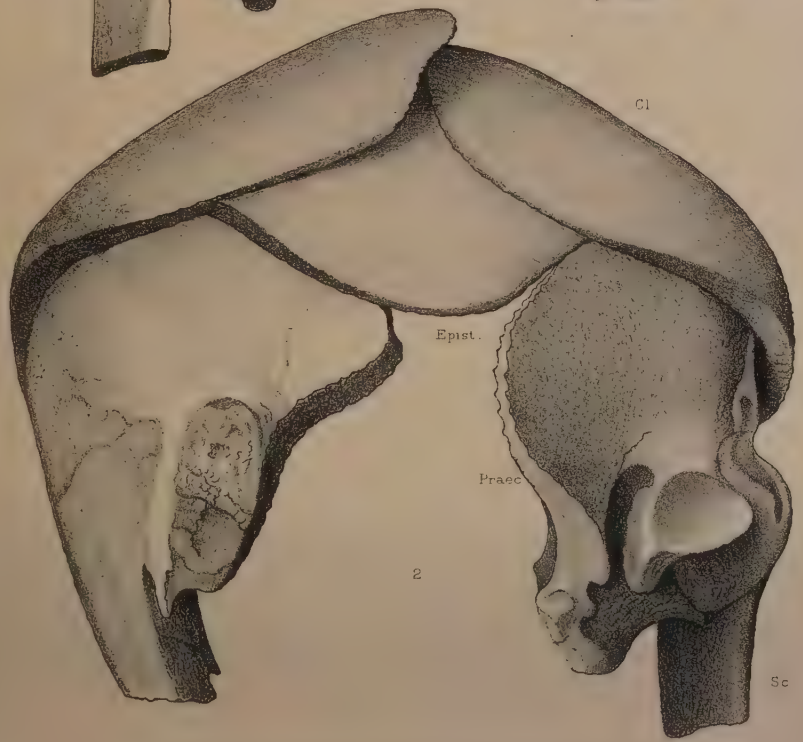
* Beiträge z. Morphogenie d. Carpus u. Tarsus d. Vertebraten, 1887, i, p. 53.

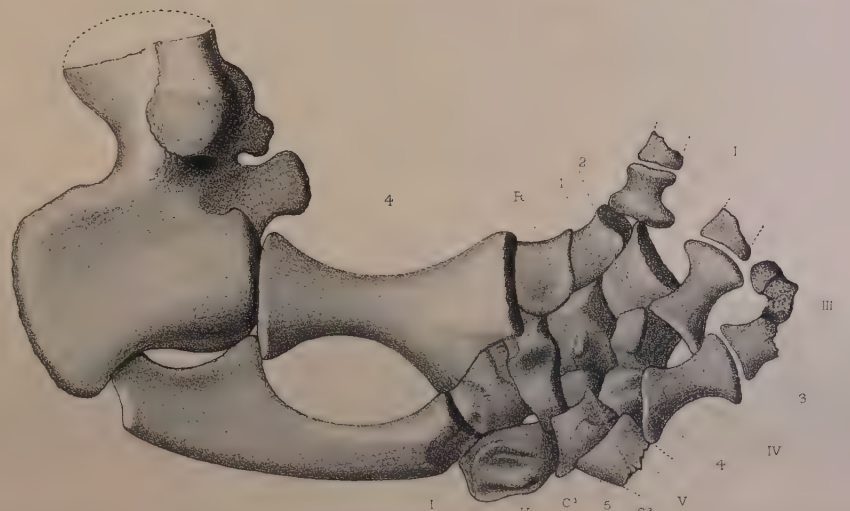












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Measurements of Posterior Foot.	*MM.*
Transverse diameter distal end of tibia	51
" " " " fibula	50
Diameters of tibiale — longitudinal (greatest)	38
Diameters of tibiale — transverse (proximally)	28
Diameters intermedium — longitudinal	45
Diameters intermedium — transverse	31
Length of centrale 1 (internal face)	20
" " tarsale 1 (internal face)	14
" " metatarsal 2 or 4	39
" " " 3	40
" " " 2 or 4	34

EXPLANATION OF PLATE.

Fig. 1. Left anterior limb of *Eryops megacephalus* from above; *1a*, the same from below.

Fig. 2. Portion of right posterior leg and foot of the same, from front.

Fig. 3. Tarsus of a small species allied to Eryops, from behind.

Fig. 4. Shoulder-girdle of *Eryops megacephalus* from above; *4a*, the same from below.

All the above figures two fifths natural size, except Fig. 3, which is one-half.

U, Ulnare; *I*, intermedium; *R*, radiale; *O*, centrale 1; *C2*, centrale 2; *F*, fibulare; *CN*, centrale naviculare; *B*, button-like tuberosity; *Ti*, tibia; *Fi*, fibula; *1–5*, carpalia and tarsalia; *I–V*, metapodials.

ARTICLE VII.

THE CRETACEOUS AND TERTIARY GEOLOGY OF THE SERGIPE-ALAGÔAS BASIN OF BRAZIL.

BY JOHN C. BRANNER, PH.D.,

PROFESSOR OF GEOLOGY IN THE UNIVERSITY OF INDIANA,

STATE GEOLOGIST OF ARKANSAS, FORMERLY ASSISTANT GEOLOGIST OF THE IMPERIAL GEOLOGICAL SURVEY OF BRAZIL.

Read before the American Philosophical Society, September 7, 1888.

PART I.

Prefatory Notes.

In the years 1875 and 1876, while assistant geologist on the Imperial Geological Survey of Brazil ("A Commissão Geologica do Imperio do Brazil"), I spent several months in examining the geology of the provinces of Pernambuco, Alagôas and Sergipe. The work done was but little more than a hasty reconnoissance, made without any maps whatever, even of the rudest kind, and without either time, instruments or appropriation for making them.

I cannot therefore refrain from expressing my reticence in regard to publishing what little I know concerning the geology of the region treated of in the present paper. Although the work of the Imperial Survey in the region was all that could have been accomplished in the time occupied, and though it was much more extensive than any done prior to my visit, it was far from satisfactory.

Three other reasons have caused this delay in the publication of my observations. First, I hoped that the Brazilian Government would see fit to have the results of the Survey's work published more in detail than is possible here. This has not only never been done, but until the publication by that government of Dr. C. A. White's important "Contributions to the Palæontology of Brazil" none of the results have been brought out, except as the former members have found time to prepare brief papers and publish them wherever an opportunity offered. Even in the case of Dr.

White's paper, the delay in its printing was very tedious, the report having been issued four years after the manuscripts and drawings were prepared. Second, I have delayed on account of the incompleteness of my observations, and because of my hesitation lest I should add to that class of writings upon Brazilian geology which is made up, to so great an extent, of generalizations based upon very limited observations. A third reason for delay has been the somewhat vague hope that I might yet have an opportunity of completing my studies. As time goes on, however, the probability of my being able to revisit the provinces of Sergipe and Alagôas appears to lessen rather than increase. Since my exploration in those provinces I have returned to Brazil three times, but as Aracajú and Penedo are small ports off the principal lines of travel, visited only by sailing vessels and small coasting steamers from Bahia or Pernambuco, I have never found it possible to make further examination of the geology of this interesting region. It is hoped, however, that these notes may be of service to those who may hereafter undertake to add to or finish the work begun.

Much of this paper must be of a statistical nature, for the relation of facts to each other, except in a general way, is not understood, and I do not deem it necessary or discreet to enter upon the discussion of these relations in detail until more thorough information is had of the region in question.

The sketch map accompanying this paper makes little pretension to accuracy and is only introduced for the purpose of giving some idea of the geography of the region under discussion.

The defects of the records are quite evident to myself, but in spite of such defects, I am confident that the facts presented will be useful to those who may hereafter have occasion to do work in this region. As far as I am aware, no geological work has been done here since 1876, if I except the trip made up the Rio São Francisco by Mr. Derby, the geologic results of which were published in the Archivos do Museu Nacional, Vol. IV, p. 87 et seq., but this paper, while it treats somewhat of the mesozoic geology of the region, does not appear to represent any new work thereon. What I have to say in this paper is upon my own authority, except where others are quoted and credit given.

I should be remiss in a most pleasant duty did I not refer here to the universal encouragement which the naturalist, traveler, or stranger meets at the hands of Brazilians in all parts of that country, and especially in the provinces of Sergipe and Alagôas. The poorest laborer kindly and politely urges you to "make no ceremony" about sharing his humble fare, while the richest gentleman assures you and makes you feel that his house and his servants are "yours" indeed. I am under especial

obligations to Robert Brown, Esq., H. B. M.'s Consul at Maroim, for assistance in the prosecution of my work in the province of Sergipe.

OUTLINES OF THE BRAZILIAN CRETACEOUS.

That the relations of the Sergipe-Alagôas basin to the other more or less similar deposits of the Brazilian coast may be better understood, I give here briefly the prominent features of the cretaceous geology of the several basins along the coast as far as they are known.

I use the term "basin," however, in speaking of the geology of the provinces of Sergipe and Alagôas partly to separate the locality geographically from others of a more or less similar character north and south, and partly because it seems to have been one of the separate wide-mouthed bays or indentations—mere curves of the shore line—which characterized this coast in cretaceous times.

The exposures of mesozoic rocks along and near the Brazilian coast point to the probability that this portion of the coast line of the Atlantic was, during cretaceous times, but slightly different from that of the present day.

The accompanying small map of Brazil will give an idea of the geographical relations of the known cretaceous exposures to each other, and will suggest, at the same time, the form of the coast at the time of their deposition.

The most southerly exposures of cretaceous rocks thus far discovered in Brazil are upon the island of São Francisco in the province of Sta. Catherina. Others occur along the coast at the Abrolhos, at Bahia, throughout the extension of the Sergipe-Alagôas basin from Estancia to Rio Formozo in the province of Pernambuco, at Olinda, Maria Farinha and on the island of Itamaricá in the province of Pernambuco, at Parabyha in the province of this name, on the Rio Mossoro in Rio Grande do Norte, and about Crato in Ceará, while the most northerly exposure known along the coast is found on Rio Piábas, province of Pará. More detailed descriptions of these several basins and localities will be given at the end of the description and discussion of the Sergipe-Alagôas basin.

PREVIOUS WORK.

A glance at the annoted bibliography of the subject given at the end of this paper will show that almost no work was done on the geology of the Sergipe-Alagôas basin prior to 1875.

In 1838, George Gardner, the English botanist, during a short voyage on the São Francisco made in pursuit of his botanical studies, made a few notes upon the

geology of the region. These notes, however, were so few as not to be worth mentioning, except for the fact that he afterwards made some valuable observations upon the mesozoic geology of Ceará, and expressed the opinion that the Penedo sandstones were "identical with those from the upper sandstones of Crato."

Charles Darwin, in his "Observations," makes references to the mesozoic geology of Pernambuco and Bahia, but he did not visit the coast between those places.

In 1866, Prof. Ch. Fred. Hartt touched at Aracajú, Maroim, and Penedo, and gives the results of his observations in his "Geology and Physical Geography of Brazil." He obtained a small collection of fossils at Maroim, but one of sufficient importance to throw light upon the age of the rocks. He noted exposures at Sapucary (by him called Sapucahy), Maroim, and through Mr. Laué, who then lived at Maroim, obtained specimens of *Natica*. The cephalopods of this collection were described by Prof. Alpheus Hyatt, and the descriptions published in Hartt's "Geology and Physical Geography of Brazil," p. 385. No explorations, whatever, had been carried on inland, or even along the navigable parts of the streams. The facts brought out in regard to the Sergipe-Alagôas region by Hartt are substantially as follows:

First. Reporting the following exposures: Estancia red sandstones, and the limestones of São Gonçalo, Sapucary, Maroim, Villa Nova, Penedo, Morro de Chaves.

Second. Reference of the Maroim beds to the upper cretaceous, it is presumed, upon the paleontologic evidence of Prof. Hyatt's descriptions of the cephalopods. The descriptions of these fossils is the only work known to have been done upon the fossils of the region up to that time. Prof. Hyatt in his paper expressed no opinion concerning the age of the beds, but what appear to be Hartt's field labels are given as "from the cretaceous of Maroim." Such was our knowledge of the geology of the region here treated of when the writer visited it as a member of the *Commissão Geologica do Brazil* in 1876.

THE GEOLOGIC IMPORTANCE OF THE SERGIPE-ALAGÔAS REGION.

Much of the Brazilian coast is very old geologically, no sedimentary beds to indicate the changes through which this part of the continent has passed intervening between the ocean and the granites and gneisses which are referred to the archæan. Along a considerable portion of the north-eastern coast, especially from Cape Sto. Agostinho to Parahyba do Norte, soft sedimentary beds, provisionally referred to the tertiary, are exposed here and there in abrupt bluffs which are being cut away by the ocean. These rocks, however, although well exposed, have as yet yielded no fossils,

and do not, of themselves, throw much light upon the changes through which the coast has passed. Nowhere along the Brazilian coast from the frontier of Uruguay to Cape North are any fossiliferous paleozoic beds exposed, and there are but few places in which a section from the ocean to the archæan rocks would pass through anything more than recent deposits and the horizontal tertiary beds referred to above.

In no place along the whole coast, however, can a wider and deeper section be found, or one in which the rocks afford a more complete history of the changes through which this part of the continent has passed from paleozoic times up to the present than the basin cut by the Rios São Francisco and Sergipe, and which lies within the two provinces of Sergipe and Alagôas. The importance of this region is due to

1. The representation of a geologic range unusual in Brazil.
2. The rich fossiliferous nature of many of the beds.
3. The accessibility of good exposure across the entire section.

Doubtless one of the chief reasons that these two provinces are not better known geologically, is the fact that they are not on the principal line of travel between Europe and South America, and are, therefore, more or less inaccessible, and if the geological importance of the region has not been recognized, it must be attributed to the fact that hitherto nothing, or next to nothing, has been known of it.

With the exception of a canoe voyage by Gardner along the Rio São Francisco to Piranhas in 1837, and a very brief visit to Maroim by Prof. Hartt in the year 1865, none of the writers upon the geology of Brazil, prior to the work done by the Imperial Geological Survey, ever visited the Sergipe-Alagôas region, and even those few earlier writers have but little to say of the geology of this section of the country.

I am of the opinion that the key to future successful geologic work in Brazil lies in the careful study and comprehension of some such typical region as that comprised in the provinces of Sergipe and Alagôas. The Bahia basin is an interesting one, and, as Dr. White has pointed out in his recently published "Contributions to the Paleontology of Brazil," faunally more interesting perhaps than that of Sergipe-Alagôas, but the Bahia basin being of lacustrine origin is *sui generis*, as far as the mesozoic geology of Brazil is understood.* The Sergipe-Alagôas beds on the other hand are marine, the rocks above the archæan vary lithologically and faunally, and are more or less exposed across the whole width of the region from the ocean to their inland margins at the base of the Serra d'Itabaiána, while at this latter locality, the lowest of the sedimentary beds are well exposed where the serra is cut through

* Pissis, in his memoir published by the French Academy, p. 402, says that the tertiary beds of the interior of Brazil, and lying between the coast range and the Serra de Mantiqueira, are lacustrine.

by the Rio Sergipe, and their relations to each other and to the underlying archæan rocks are distinctly shown.

Aside from its purely geologic interest and importance, there is, perhaps, no part of the coast north of Bahia so fertile, the soil being of the black quality known here as *massapé* and derived from the decomposition of certain limestones and of organic matter. Wherever the tertiary beds have been eroded away exposing the underlying cretaceous rocks, the decaying of these calcareous beds has produced a soil, which, in spite of indifferent cultivation, yields abundant crops of sugar-cane, cotton, mandioca, etc. Although the cane-fields upon some of the cretaceous soils have not been replanted for thirty years, they still produce abundantly.

TOPOGRAPHIC FEATURES AND VEGETATION.

The topography of the Sergipe-Alagôas region may be divided into the following five types:

I. The low, flat lands of quaternary and recent origin, immediately bordering the coast and streams.

II. The tertiary plateaux.

III. The cretaceous hills.

IV. The serras, or paleozoic region.

V. The trans-serra, or archæan region.

I. *The low, flat lands.*—In some places these flat lands are made up of sand barrens, or they are covered with sand dunes; in others they are low grounds flooded at high tide, and usually form what are known as mangues, or mangrove swamps, bordering the estuaries. This type, or rather the mangrove part of it, is not confined to the immediate neighborhood of the ocean, but extends inland as far as the tides are felt, sometimes for many miles, and in general outline has a dendritic form. On the Cotinguiba it reaches the town of Larangeiras, on the Sergipe that of Riachuello, and on the Maroim branch it reaches the city of that name.

The vegetation of this belt is a characteristic one. The mangues are in no particular different from those to be found along the whole Brazilian coast, except, perhaps, in the blackness of the mud where it is derived from the decomposition of the calcareous cretaceous rocks and organic matter. In places these mangues broaden out until they are from two to five miles wide, and in other places their outer margins approach the streams where the latter are encroached upon by the hills. Thus they are at once the characteristic feature of a well-defined topographic type, an important geologic agent, and an interesting form of vegetation. When the mangrove plants

(*Laguncularia racemosa* Gaert. and *Avicennia tomentosa* Lin.) have reached maturity, the mangues (swamps) are very nearly, if not quite, impenetrable, and the rapidity with which old vegetation decays and young vegetation seizes upon new and reclaimed lands in the tropics, make them a more powerful agent in the accumulation of sediment and organic matter than are the mangrove swamps of Florida.

In its predominant features the belt of sandy lands and dunes does not differ in any marked degree from that of any sandy coast. The sands drift with the winds, and the configuration seen at one time is entirely obliterated a few weeks or a month later.

Not infrequently these dunes are driven into the edges of the thick forests which grow upon the adjacent topographic belt, but beyond this margin they cannot penetrate far. The effect of the blown sand upon the vegetation in such cases is very marked. The flying grains soon bruise and kill the buds and tender leaves and ultimately a peculiarly rounded, lobed and closely cropped appearance is given to the windward margins of the forests. Although these dunes do not assume the proportions in this part of the empire that they do in some of the more northern provinces,* the entire coast of Sergipe and a large portion of that of Alagôas are covered by a sandy belt which varies in width from five hundred feet to two or three miles.

In some places the dunes predominate, the shifting sands often encroaching upon and burying mangrove swamps and the underbrush of adjacent forests, while in others they form broad, flat glades with a sparse and characteristic flora of cajús, cacti, etc. From the Barra de Japaratúba to the mouth of the Rio Cotinguiba the unbroken line of dunes thrown up by the prevailing east winds has here arrested the drainage and turned it westward through the Rio Pomonga which flows into the Cotinguiba just north of Aracajú.† To the south of the Cotinguiba these dunes often assume extraordinary proportions.‡

The vegetation of the sandy belt is necessarily sparse at the best. Wherever the sand is constantly shifting, as it is in the newer portions of the belt, vegetation has no opportunity to take root. In those portions, however, in which, for any reason, the sands assume more or less stability, certain drought-resisting forms of vegeta-

* There has been some speculation regarding the origin of these vast accumulations of sand along the Brazilian coast, and especially about Cape St. Roque, M. de Jonnes holding that they are brought to these shores by the equatorial current (see Ceará, by Pompeo de Souza, p. 13), while Dr. Capanema holds that they come from the Serra do Araripe. Whatever may be the origin of the sands north of Parahyba, south of that point they are derived directly from the rapid cutting away by the ocean of the soft tertiary beds.

† See also Relatorio da Commissão Hydraulica do Rio São Francisco, by W. Milnor Roberts, Rio de Janeiro, 1880, p. 4.

‡ See Geology and Physical Geography of Brazil, by Chas. F. Hartt, p. 380.

tion quickly take root and flourish upon it. The cacti are naturally in this list, and I have found one species of fern here, while the cajú tree, one of the blessings of the country, seems to reach its highest development in this parched and arid soil.

II. *The tertiary plateaux.*—This and the succeeding types can best be understood by anticipating somewhat the succession of geologic events in this region. The cretaceous formation was here overlain by not less than two hundred feet of horizontal, particolored beds of soft sandstones and clay. Since the emergence of the region from the ocean, the overlying tertiary beds have been extensively eroded. Where the tertiary beds have not been entirely washed away, flat-topped, angular-shouldered hills still cover the cretaceous beds, and form the topographic type under consideration. These plateaux are not confined to any particular belt, but may be found anywhere between the ocean and the serras. The tertiary soils are, as a rule, very sterile, their sterility being due partly and directly to the character of the soil and partly to its tendency to wash, and its inability to receive and retain sufficient moisture to support vegetation. The natural growth of vegetation upon this soil is strikingly poor, and this region of plateaux is generally covered with a sparse and stunted growth of forest and sedge, while the land is extremely barren, and unfit for cultivation. It is also seriously affected by droughts. Types of this topography occur between Maroim and São Christovão.

III. *The cretaceous hills.*—From what has been said it may be anticipated that the region of the third type owes its existence to the erosion of the tertiary beds, and the consequent uncovering of the underlying cretaceous. While this is true in the main, there are certain elevations in this basin which I am disposed to regard as never having been covered by the tertiary deposits, certainly not to any considerable thickness. In making a voyage between Aracajú and the mouth of the Rio São Francisco, one may see a range of cretaceous hills lying south of the river and well inland, though disconnected with the higher lands of the serras. This range of hills stands at a higher elevation than any of the tertiary hills on either side of it, and for reasons given further on, it is not believed that the erosion from the summits of some of the tertiary hills has been very extensive.

The region on the whole is a broken one, the hills being more or less rounded as a rule, though a few of them have abrupt faces toward the north and west. Although the topography of this region is a characteristic one, its value for the purposes of geologic reconnoissance is somewhat impaired by the presence of the overlying tertiary beds in a great many localities. This type characterizes the region between Aracajú and Itabaiána and between Larangeiras and the serras. The vegetation is large and abundant, and within this belt one may often find excellent examples of the

ideal tropical forests having an undergrowth well-nigh impenetrable and trees whose enormous trunks reach heights almost incredible.

IV. *The serras, or the paleozoic region.*—This type lies to the north and west of the mesozoic region, and forms a well-defined, natural boundary between it and the archæan region which lies farther inland. In the province of Alagôas this border is formed by the Serra de Marába, which, in its continuation to the south-west, is called the Serra d'Itabaiána, and still farther to the south Cajahyba. This entire range is the monoclinal remains of the eroded landward margin of the beds here exposed. The rocks dip to the east and south-east at an angle of from fifteen to twenty degrees, and underlie the cretaceous and other beds between the serra and the ocean. For the most part these serras are covered with forests nearly to their summits.

V. *The trans-serra or archæan region.*—The topography of this region is an exceedingly varied one; now hilly, now mountainous, and now spread out in gently undulating plains. In some places it is notoriously sterile and is covered, for the most part, with a sparse growth of stunted timber, while in others it is more fertile, and produces a more vigorous forest. But little time was devoted to the geology of the archæan region.

THE SERGIPE-ALAGÔAS BASIN.

It will be seen in the resumé of what we know of the mesozoic geology of Brazil that too little is known of the exact limits of the cretaceous basins along the north-eastern coast of South America to permit a single one of them being clearly and satisfactorily outlined. More work has been done on the Bahia basin than upon any other one of the number, but of even this the limits are not known. For the better understanding of the region, it is deemed best, however, to give such facts as are available in roughly outlining the Sergipe-Alagôas basin, before giving the details of local geology.

The Bahia beds being of lacustrine origin, while those to the north are of marine origin, it may safely be assumed that these two basins were independent of each other at the time of the deposition of their beds. The most north-easterly point at which the Bahia cretaceous is known to occur is near Catú in the province of Bahia, and the most southerly point at which the marine cretaceous beds of the Sergipe-Alagôas basin have been observed, is at and about Estancia, in the province of Sergipe. The southern margin of this basin must, therefore, be to the south of this place. The rapids in the Rio Real, known as Passagem das Pedras, suggests the possibility of the red sandstones, which make the cataracts at Estancia, crossing the Rio Real at Passagem.

To the north of Estancia no exposures are known until one approaches the Pedra da Cajahyba which forms a part of the Itabaiána range of mountains.* From this part of the province to the Rio São Francisco near Propriá the mesozoic basin is bordered on the landwards side by the eastward extension of this same range of mountains. In the province of Alagôas, the Serra de Marába forms the north-west boundary, and by its trend leads one to suppose that this north-west margin continues for some distance in a line parallel to the coast.

Just where this basin ends to the north-east, and indeed whether it ends at all, either within the borders of Alagôas, or of Pernambuco even, is not known. The geology along the coast between Maccio and Rio Formozo has never been examined, and it is possible that this basin comes to an end between these two points. The writer feels warranted in the opinion—though it is only an opinion—that Porto Calvo is in the Sergipe-Alagôas basin, and it is possible that its beds are exposed at Rio Formozo. An examination of the relations of the archæan rocks and what was at the time supposed to be the tertiary beds at and near the mouth of the Rio Formozo in the province of Pernambuco, does not definitely settle the question as to whether or not the cretaceous beds continue to the north of this point. The beds seen at Rio Formozo lie unconformably against the crystalline rocks, but it is not clear whether the beds supposed, at that time, to belong to the tertiary do really belong to that period. They are, in general appearance, certainly unlike any tertiary beds seen elsewhere in Brazil, being made up of alternate beds of conglomerate, clay, chalk and chalk with flint nodules.

If then the cretaceous beds are continued from Alagôas and extend to the north of Rio Formozo, it is possible that they underlie the tertiary about Cape Sto. Agostinho, and are continued on the landward side of that cape, underlie Pernambuco, crop out at Olinda, Maria Farinha, Iguarassú, the island of Itamaricá, and may even connect with the mesozoic beds exposed at Parahyba do Norte and further north.

LOCAL DETAILS.

The present discussion of the Sergipe-Alagôas basin must be based upon facts gathered for the most part in the vicinity of Maroim, the Serra d'Itabaiána, along the Rio São Francisco and the Serra de Marába.

* The beds of this range which I have referred to the paleozoic probably underlie the cretaceous beds of all this part of the coast. In a letter to me, in answer to one making inquiry regarding the nature of the region traversed by him from Bahia to Sergipe, Mr. Derby writes: "In the trip across Bahia and Sergipe, I found a series of shales and sandstones in the region between the Rio Real and Itabaiána which is most probably the same seen in the mountains. So far as I could see, there is nothing between that and the gneiss."

BARDWELL

These and the other localities mentioned below are the only ones examined that are judged to be of sufficient importance, or at which sufficiently valuable observations were made, to be worthy of mention here. Hundreds of places were visited in this region at which poor exposures of cretaceous rocks were found, but they could throw no additional light upon the geologic structure of the region without the use of more trustworthy methods of work than it was possible to employ at the time.

Inasmuch as the tertiary geology of this region is the subject of the second part of the present paper, the beds of this series are not discussed in this place.

In view of its general importance and the light it throws upon the structure of the entire region the details of the Itabaiána exposures will be taken up first.

Itabaiána.—The best section seen of the rocks underlying the mesozoic beds are exposed where the Rio Sergipe cuts through the range of mountains of which Itabaiána forms a part. Here the crystalline rocks are exposed on the inland side of the range, and in the gap cut by the river, the unconformable contact between these and the sedimentary beds, which are presumed to be paleozoic, is plainly seen. The conglomerates, false bedded sandstones, and shales which make up the great body of the section, have been so metamorphosed that the prospect for finding fossils in them is not very encouraging.

The sandstones are almost all changed to exceedingly hard, glassy quartzites, which by much jointing have broken into smooth-sided rhomboidal blocks. Following down the stream one ascends geologically, and finds these quartzites and conglomerates the principal rocks exposed, while those of shale, in which one most hopefully looks for fossils, are but poorly exposed or entirely covered with talus from the overhanging ledges. These beds have a pretty uniform dip of 15–20° to the south-east. Along the escarpment of the north face of the mountain range the upturned edges of the uppermost beds are partly exposed, while all the lower ones are covered with talus which stands at as high an angle as possible. In this talus large fragments of shale, such as was not seen in situ were examined for fossils, but without success.

The brief time spent in examining the rocks of this section for paleontologic evidence of their age was very insufficient, and it is altogether probable that careful detailed examination of these beds will yet furnish the desired evidence.

From the top of Itabaiána the structure of this range of mountains and its geologic relations to the regions on either side of it are quite evident. The Itabaiána peak is at the base of a curve in the range which continues to the right, as one faces the ocean, towards the west and south-west, while to the left it extends to the north and north-west. About fifteen miles to the north the range turns eastward and is next

seen prominently on the Alagôas side of the Rio São Francisco, where it is known as the Serra de Marába. To the south-west different portions of the ranges are known by different names, the section next to Itabaiána being called the Serra Comprida, and that next the Cajahyba. It is evident at a glance that this range of hills bears the same relation throughout to the general Sergipe-Alagôas basin as the Itabaiána beds bear to those lying immediately between them and the ocean.*

The section across the region given below shows the general relations of the various beds.

The following sketch looking north-east from the top of Itabaiána, shows the

Looking north-east from Itabaiána.

continuation of the range in a line of detached peaks, the rocks of which all dip oceanward beneath the mesozoic beds. Fig. B. is a sketch from near the south-east

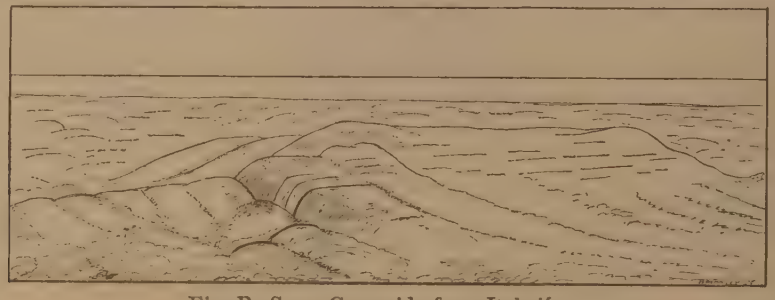


Fig. B. Serra Comprida from Itabaiána.

end of Itabaiána peak, looking toward the south-east. The beds of the Serra Comprida are seen from the inland side, somewhat, and appear to be faulted.

The Itabaiána Section.

The accompanying section across the Sergipe-Alagôas basin is represented as being drawn from the archæan region north of the Serra, through Itabaiána, Maroim,

* See note by Mr. Derby, on p. 378.

and Sto. Amaro to the sea. No attempt is made to represent relative thicknesses accurately, for no measurements have been made that will render this possible.

Section across the Sergipe-Alagôas basin.

Beginning at the base of the section, M represents the crystalline rocks of the archæan, here composed of beautiful greenish gneisses containing amethysts and yellow mica. At the point of contact the surface is uneven but hard and rounded as if water worn, and the conglomerates of the lowest of the paleozoic beds lie unconformably upon it. The gneisses at this place dip to the north-west though much crumpled in places. The same rocks when exposed away from the line of contact are soft and deeply decayed.

The lowest bed of K is a coarse and very hard conglomerate made up largely of fragments from the underlying gneiss. The next bed above is of coarse sand and pebbles, false bedded, followed by sandstone of varying degrees of coarseness. The pebbles in this bed are of all sizes up to that of one's fist, and vary in color from the white of milky quartz to the green of the underlying gneiss from which the latter are apparently derived. Next follow very hard sandstones with ripple marks, then fine, fine-grained sandstone. This is succeeded by fine-grained micaceous slaty rock with ripple marks, then very hard conglomerate followed by solid fine-grained slate, and coarse sandstone with micaceous bands.

These beds are all exceedingly hard, the sandstones being usually in the form of jointed and strongly false-bedded glassy quartzites. They have a uniform dip of from 15° to 20° to the south-east.

Of the thickness or importance of the rocks between the beds just mentioned and the next observed, nothing is known. On the sides of the hills immediately east of Itabaiána a series of slates, shales and sandstones were seen, but it was too imperfectly exposed to admit of a complete section being made, or of connecting such a section directly with that in the Rio Sergipe gap. On the part of the mountain east of the river the rocks dip south and south-east. The next overlying beds seen are limestones exposed on the stream between Itabaiána and Serra Comprida. Where they were examined they are considerably disturbed, very compact, and traversed by small veins of white quartz. In general appearance these rocks resemble the mountain limestones of England, but no fossils were found in them.

It is presumed that these limestones are included in the paleozoic beds which extend still higher. There is another break in the section here caused by the impossibility of observing the sequence of the overlying beds.

The next rocks seen, and of which the stratigraphic relations are known, are the mesozoic sandstones found in the hills at Engenhos Araçá and Pamonha, and which appear to dip gently to the north-west, that is, in the direction of the serra.* This dip necessitates at least one syncline between this place and the mountains. Above these follow various beds of sandstone and limestone which are described more in detail elsewhere, all of which appear to belong to the cretaceous, with certain exceptional facies referred to in speaking of the age and correlation of the mesozoic Brazilian beds.

The cretaceous beds are somewhat disturbed, and some of them slightly metamorphosed. They are richly fossiliferous in places, and have furnished the interesting series of fossils described by Dr. White in his "Contributions to the Paleontology of Brazil."

The horizontal tertiary beds (B) which overlie these do not end along a well-defined line as one might infer from the section, but seem to have covered at one time almost all the mesozoic rocks, and to have been largely removed by denudation, leaving shoulders here and there, some of them but a few hundred feet and some of them miles in width. These beds are horizontal as far as the unaided eye can determine, non-fossiliferous, and are made up of particolored alternating strata of clays and sands, with here and there calcareous bands and concretions.

The last beds are those of quaternary and recent times which lie against the tertiary, cretaceous, paleozoic or archæan as the case may be.

Recapitulation.—Explanation of the section:

M. Archæan, (?) schists.

K. Conglomerates, sandstones and shales of the Itabaiána series, partially metamorphosed.

H. Not seen.

G. Limestones and shales.

F. Not seen.

E. Sandstones of Pamonha and Araçá.

D. Oolitic limestones and sandstones.

C. Chalky beds of Sapucary, Andorinhas, etc.

B. Horizontal tertiary sandstones and clays.

A. Quaternary and recent.

* The fossils from these beds are referred to in Dr. White's work as coming from "Pamona," which should read Pamonha.

EXPOSURES ABOUT MAROIM.

Quarries have been opened in many places in and about Maroim from which stone has been obtained for building walls and houses and for paving the streets. One of these quarries on the western side of the town is known as the *pedreira de Gambarobe*. The rock at this quarry is a brownish gray limestone, more or less oolitic, and contains some fossils, though the shells are usually broken and difficult of extraction. Lamellibranchs, cephalopods, decapod crustaceans, echinoderms, and occasionally very large gasteropods are found by the quarrymen. Many bits of fossil wood are also found here, but all in a charred condition.

On the eastern outskirts of the town, and lying more or less in it, at a place known as Aroeira are several old, abandoned quarries in calcareous sandstones. These beds contain many fossils, but the rocks are too hard to allow them to be taken out in good condition. The dip here is generally toward the east at a low angle. The fossils described by Dr. White from the Riacho de Aroeira are all from a small exposure in the bed of a wet-weather stream to the north-west of the quarries. At this place the rocks are more sandy than at the quarries referred to, and sometimes are hard as quartzites. They lie directly beneath the beds exposed at the quarries of Aroeira and dip to the S. 80° E., at an angle of six degrees. In the lowest part of the bed are fragments of the softer yellow rock which lies at a lower geologic level, forming, with the sand, a kind of conglomerate.

Lastro.

The richest locality for fossils found in the vicinity of Maroim is one known as the Lastro, about two miles down the river from the town, on the east side of the stream, and just south of the Engenho da Praia. From this engenho the exposures continue for more than three miles along the hills that border the stream on the east.

The fossils described by Dr. White from this locality come from the border of the mangue along the first three-quarters of a mile below the engenho. In this distance the rocks furnishing the fossils are mostly soft, decaying, cream colored to brown, oolitic limestones, which, by disintegration, have left the fossils free. In places the small rock fragments are so full of echinoderms that they can be picked out like walnuts from their hulls. In some cases the material of these fossils is changed to pure calcium carbonate, while in others the more compact beds of limestone have the fossils silicified so that they can be perfectly removed by the use of acid to dissolve the limestone.

The weathering out of the fossils at this place is hastened by the tides which

alternately cover and expose them to the air and sunshine. These same beds are exposed also on the opposite side of the river at a place called Jaque, where the stone was formerly quarried at low tide. Here, however, the rocks are harder than those at the Lastro exposure, the fossil fauna being the same.

The rocks at Jaque are oolitic, of a light-brown color near the surface, but where they have been blasted, or their interior parts are unaffected by weathering, they have a bluish-gray color.

Rocks similar to those found at the Lastro and Jaque occur from two to three miles further down on the west side of the stream. Here too the black flints which seem to have weathered from some limestone beds are widely scattered. The beds from which the flints have been derived overlie the oolitic rocks exposed at Lastro and Jaque. On the east side of the stream the rocks overlying the oolitic beds are soft limestones such as are exposed about Porto da Rede. On the west side the soft limestone beds are more or less flexed.

The fossils most abundant at the Lastro are conchifers, cephalopods and echinoids. There were found here sixteen species of conchifers, of which number ten are new to science; nine species of cephalopods, six of which are new; ten species of echinoids, nine of which are new. Gasteropods are remarkably scarce, but two species having been found here, both of which are new.

*Pedreira de João Pereira.**

This quarry is about two miles east of Maroim. The rock is a soft, cream-colored to yellow, oolitic limestone, affording many imperfect specimens of cephalopods. The rock is so soft that it is quarried in blocks by cutting trenches in it with picks. The fossils are bivalves and cephalopods. Three species of the former and three of the latter have been found here, all of which are new to science. The beds have a southerly dip.

Garajáu.

This locality is immediately north of the town of Maroim, and is interesting as containing the rocks from which one of the conchifers described by Dr. White as of jurassic aspect (*Aucella braziliensis*) was obtained. Most of the fossils obtained here are cephalopods (*Ammonites hopkinsi*) and were broken from compact limestone blocks where they had been separated by disintegration from the main beds, which crop out here and there about the fields. These beds overlie those of Aroeira, Lastro, Jaque, Gambarobe, etc., all of which are oolitic.

* This locality is wrongly given in Dr. White's Paleontology as João Ferreira in some places, while in others it has the correct spelling.

Jacuruna.

At Jacuruna, a short distance north-east of Maroim along the *estrada real* leading to the village of Rosario, is an exposure of oolitic limestones containing a few fossils. To the west of the Ponte de Sabão bridge, is a hill having outcrops of similar rock on either side. An exposure of limestone passes east and west through the village of Rosario. In one place where this stone is quarried, a bed thirty-five feet in thickness is exposed. The rock is oolitic and in lithologic characters strongly resembles that of the Gambarobe quarry in Maroim. The uppermost ten feet forms a massive bed. These beds dip at an angle of twenty degrees S. 45° E. (direction estimated). Between this point and Campo Redondo the country is low, these cretaceous rocks and their hills forming the southern boundary of the valley, while a range of tertiary hills bounds it on the north. Soft, cream-colored, cretaceous limestones underlie these tertiary hills as was shown in the pits excavated north of Engenho Campo Redondo in a search for coal or gold. From one of these pits, ten feet deep, a few fragments of fossils were obtained, one of which, *Camptonectes placitus* White, is described in Dr. White's "Paleontology of Brazil."

Coqueiro.

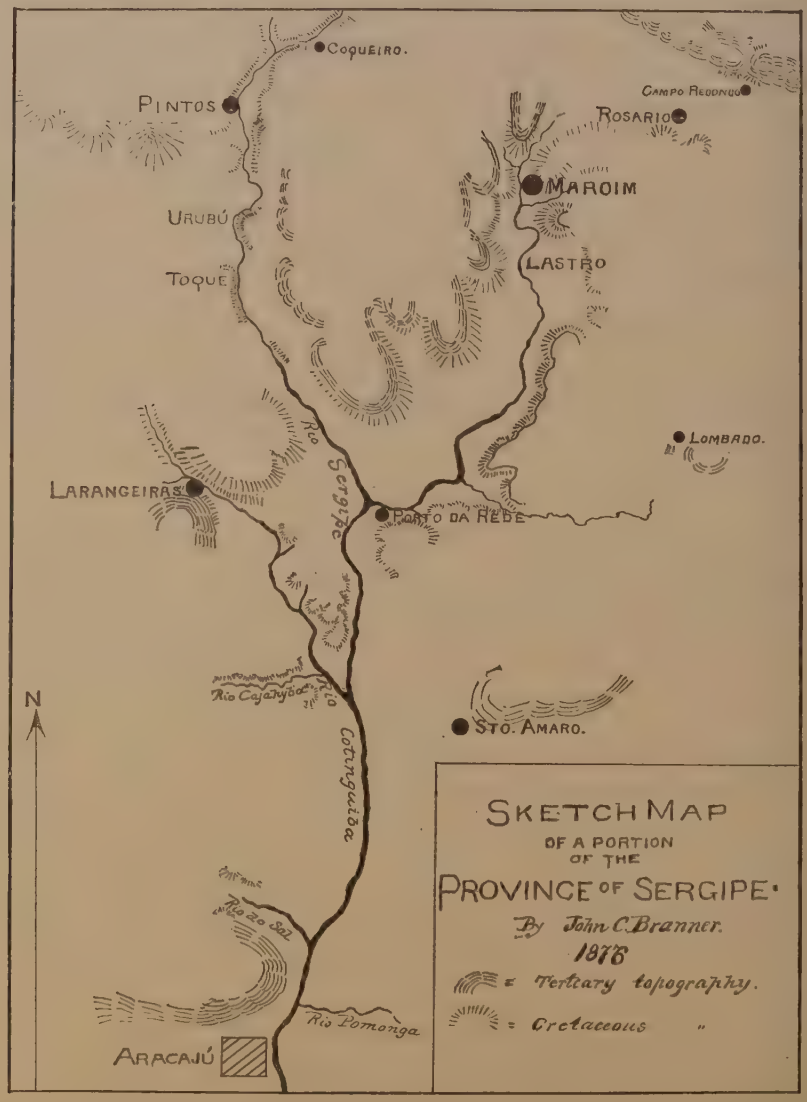
Most of the material collected at Coqueiro came from a single locality, a small exposure in the *estrada real* within a few hundred yards of the engenho of this name. The rocks here are sandstones of very uneven texture, being in some places hard, in others soft, in some places fine grained, in others coarse and porous, while in others still they contain a great many quartz and other pebbles. Among these pebbles are some of black quartzite resembling very strongly the dark quartzites found in situ in the serra d'Itabaiána. Owing to local variations in the character of these sandstones, some portions of the beds contain no fossils, all of them, if any ever existed in such places, having been removed by percolating waters. The most abundant fossils are conchifers, *Trigonia subcrenulatu* being especially plentiful, and these occur for the most part as moulds or casts, the shells having been entirely dissolved out. In some of the finer-grained portions of the beds many impressions of small and delicate lamellibranchs are found, but the rock is so friable that they can be extracted only with great difficulty. The scarcity of gasteropods in these beds is somewhat striking.

To the north of the engenho is a small quarry in which the rocks are very hard yellowish sandstones, from which the fossils cannot be successfully removed. East of the river (Sergipe), at a place called Pocinhos, about seventy-five feet of sandstone is exposed. This exposure also shows a wide range of material in its composi-

tion, being in places very fine, in others containing a few pebbles, while in others it is a decided pudding stone containing cobbles half the size of one's head. Fossils are very scarce here, only a few bivalves being found in the lowest beds. The fact that the collections made here afford several fossils of jurassic aspect renders the locality one of special interest.

The beds are identical with those exposed at Porto dos Barcas, Trapiche Maior, Trapiche das Pedras Velho and Trapiche das Pedras Novo, though they vary considerably between these various localities in lithologic characters.

EXPOSURES ALONG THE RIO SERGIPE.



Many of the paving blocks and stone steps used in the village of Riachuello (also called Pintos) are filled with small gasteropod shells and other fossils, and a

small collection of the fossils of the neighborhood was made at one time by Dr. Dionizio Eleuterio de Meneses, the proprietor of Engenho Moleque near the village. At this engenho is an exposure of soft sandstone, but the fossils in it are not well preserved or readily extracted. The rocks in the vicinity of Riachuello were not examined thoroughly, and no doubt more interesting localities than any found remain to be explored here. Between the village and the engenho Jesus Maria José are several localities which yield good fossils. At the last-named place an exposure in the public road furnishes an abundance of them. Another locality is the Engenho São José de Vieira, and between it and São Felix are the largest and best preserved gasteropods found anywhere in the Sergipe-Alagôas basin, many of them lying weathered in the fields. A few of these were collected, but they seem to have been lost, for they were not included in the collection sent Dr. White with the other mesozoic material from Brazil to be described. At São Felix is the only exposure between the São José de Vieira locality and Riachuello.

At Trapiche Santa Maria in the outskirts of this village and on the river bank, a soft, non-fossiliferous sandstone is exposed, having a low dip to the north 15° east. This rock, in general appearance, very strongly resembles that exposed at Araçá and Pamonha. At Trapiche das Pedras many large gasteropods were found in a calcareous sandstone on the east side of the river.

About two hundred yards up the river from Trapiche Maior is a ledge of soft sandstone exposed at the margin of the stream near a tile factory, and containing many fossils, and especially bivalves. At Porto dos Barcos an exposure at the margin of the river, and which is uncovered at low tide, dips N. 20° E. The rocks at all the above localities dip beneath the oolitic limestones of the Urubú and Imbira bluffs.

I find in my field notes, written upon the spot, a statement to this effect: That "the Coqueiro beds are the same as those of Trapiche Maior, Porto dos Barcos, and Trapiche das Pedras." The importance of these facts will be made apparent in the discussion of the jurassic aspect of some of these beds. My notes upon the detailed geology of these localities (Porto dos Barcos, Trapiche das Pedras, and Trapiche Maior) are meagre, the collecting at these places having been done principally by Dr. Freitas.

Urubú and Imbira.

The locality known as Urubú is a bold cliff of oolitic limestone of grayish and greenish gray color, from one hundred to two hundred feet high, having a N.-S. trend, and dipping approximately 37°, S. 70° E. Along the weathered face of this

bluff many well-preserved specimens of *Echinobrissus freitasii*, White, were found. Below this point another and similar exposure of cream-colored to gray oolitic rocks, about seventy-five feet high, is known as Imbira. The rocks here dip about 30°, S. 70° E. These oolitic limestones are weathered along the joints, and contain many large caverns from whose roofs stalactites descend to their floors.

At Canna Brava white to gray oolitic rocks dip S. 45° W. at a low angle. Below Canna Brava, at a locality on the west side of the river, known as Toque, are good exposures of limestone. These rocks are somewhat metamorphosed in places, and only one bed yields many fossils. The rock is firm and compact, and weathers in jagged, irregular masses which, when struck with the hammer, ring like "clink-stones," from which peculiarity the place doubtless takes the name "Toque." In a few places caverns are developed in it. The beds here dip about 20°, S. 65° E.

About a thousand feet below Toque similar beds are exposed at Capoeira on both sides of the river. On the west side these form a bluff about one hundred feet high. Being very compact and partially metamorphosed, they furnish but few fossils, and these come from a single stratum and bear a strong resemblance to those found at the Lastro locality near Maroim. The exposures on the left bank of the river dip 13°, N. 70° W., while upon the right bank the dip appears to be S. 70° E., angle not determined. Rocks similar to these are exposed again further down the river at several places, the most important one being known as the Pedra Branca. Here they are exceedingly compact and partially metamorphosed, in places resembling marble, while the fossils have been almost entirely obliterated, the ones found having a general resemblance to those of the Lastro locality. The exposed upper surfaces of the rocks weather in sharp, jagged points.

Half a mile from this point on the river, at the margin of the mangue, are found fragments of a bed of limestone cropping out at the base of the hills, which fragments contain a great many flint nodules.

The only other exposure of importance on this stream, that is, on the Rio Sergipe proper, and below the last-mentioned place, is at the limestone quarries of Andorinhas. At several places soft, cream-colored flagstones are quarried both for paving stones and for making lime. In general appearance these limestones resemble those quarried at Sapucary, though they are not quite so pure or so fine grained. These rocks contain occasional imperfect impressions of large cephalopods and the remains of decapod crustaceans. The dip here is generally toward the east, though the rocks have some appearance of being flexed.

The next exposures down stream are those of the Sapucary quarries on the west

The Caverns of Urubu, Rio Sergipe.

side.* The rock here is a soft, cream-colored limestone, in laminæ from one to five inches thick, and coming out as flagstones. These flags are extensively used for paving-stones in Aracajú. They dip to the east at an angle varying from 25° to 40°. But few fossils have been found in these rocks, and these have been the scales of fishes. The locality is described also by Prof. Hartt in his "Geology and Physical Geography of Brazil," p. 383.

These Sapucary beds appear to be the highest of cretaceous age exposed in this region, the next exposures to the east being coarse, ferruginous sandstones, which, in all probability, belong to the tertiary. If, from Sapucary, one ascends the stream toward Maroim, many cretaceous exposures may be found in the vicinity of Porto da Rede. The rocks to the east of this village are limestones, both hard and soft, many of them containing black flint nodules. They are exposed in many places near the water's edge, along and in the margin of the mangues. The dip is approximately to the east at an angle varying from 25° to 35°. None of them form prominent features in the topography of the neighborhood.

EXPOSURES ABOUT LARANGEIRAS.

The most interesting place in the vicinity of Larangeiras is just outside the town, along the road leading to Maroim. Here hundreds of large cephalopods (mostly *Ammonites* (*Buchiceras*) *harttii*, Hyatt) and echinoderms (*Echinobrissus freitasii*, White) lie weathered out in the road. Some of these fossils are badly bruised by the wear of travel and their being knocked against one another, while others, more recently weathered out, are fairly well preserved. The material from this locality, and belonging to the Commissão Geologica was labeled "Bom Jesus" after the name of the engenho to which the lands belong, and this is the locality referred to in Dr. White's descriptions. From this point toward Maroim, at the Engenho Pedra Branca, is a quarry of impure limestone dipping south-west.

A half a mile west of Larangeiras is a place known as the Pedra Furada, or pierced rock. A bed of limestone about twenty feet thick is here exposed in an isolated bluff made prominent by lateral weathering. Lithologically this rock strongly resembles that found at Capoeira and Toque on Rio Sergipe, and of which bed it seems to be the southward extension. The strata dip about S. 45° E. at a low angle.

* Prof. Hartt gives the name of this place as Sapucahy, and in the notes sent Dr. White by Mr. Derby on the geology of the province of Sergipe the name is so given. Sapucahy being the name of a Brazilian tree, it is quite natural that this mistake should have occurred, and that it should be held as an intelligible word. In spite of this the people at and about the place called it Sapucary, and this, of course, determines its name.

In the town of Larangeiras is a quarry on the east side of the stream, the rocks having a general resemblance, both in lithologic appearance and in fossils, to the harder portions of the Lastro and Jaque exposures near Maroim.

Several outcrops of cretaceous rocks occur along the Cotinguiba, the stream upon which Larangeiras is situated. Above the mouth of the Rio Cajahyba which flows into the Jacaresíca from the west, there is a quarry of white limestone at the Caes da Ilha on the east bank of the river. A section of about twenty feet of this rock is exposed here. At Oiteiro Galante, on the east side, the same rock shows again in a less prominent exposure. Neither of these places was carefully examined by the writer.

ESTANCIA.

At Estancia the most prominent rock exposures are the red sandstone down which runs the cataract of the Rio Piauhy at this place. In general appearance these beds resemble, in a very striking manner, the triassic red sandstones of New Jersey, United States, and also those at Penedo on the Rio São Francisco. No fossils have been found in them.

Between the city and the port on the river the rocks exposed are dark-brown sandstones varying to conglomerates containing pebbles of gneiss and clay ironstone concretions of various sizes up to six inches in diameter. These rocks have a dip of from two to five degrees to the north-west. I am inclined to think, however, that this is an exposure of tertiary instead of the harder sandstones so well shown in the river.

At Ribeira Velha are exposures of the tertiary. The locality of especial interest in this neighborhood is a place known as São Gonçalo, where a few cretaceous fossils were found. The exposure, however, is a very insignificant and unsatisfactory one, where the soft limestones have been dug out for making lime. In this exposure the beds are gently arched, the most prominent dip being to the north-west (?). The uppermost bed is a coarse white sandstone, next below comes a band of fine, soft limestone, then gray limestone of a chalky appearance, and at the base a bed of plastic blue clay. The quarrymen spoke of having found *panellas* (frying-pans) in the rocks, which, from additional descriptions, were supposed to be large cephalopods. No examples, however, were seen.

THE MARÁBA SERIES.*

That the Marába beds bear the same relation to the mesozoic rocks in the province of Alagôas as do those of Itabaiána to the mesozoic rocks in Sergipe, there can

* The Serra de Marába is said to be the highest point in the province of Alagôas.

scarcely be a doubt. Looking north-east from the Rio São Francisco, a short distance below Propriá one sees the Marába as shown in the following cut; the inland

Serra de Marába from near Propriá, Rio São Francisco.

or north-west side of the hills presenting abrupt faces, the south-east slope having a gentle dip toward the sea, suggesting that, if composed of sedimentary rocks, they must dip beneath the horizontal tertiary beds which cover the greater part of the region in the immediate vicinity of the mountain.

An examination of the country between Penedo and the serra shows that this impression is the correct one. Leaving out of account the sandstones underlying the city of Penedo, in going from this place to Marába, one traverses a wide belt of low, flat, fertile country which borders the river, and which is more or less flooded by the *enchentes* or "freshets" of the Rio São Francisco. From this low country he rises gradually and almost imperceptibly upon the taboleiros or plateaux, which are composed of the horizontally bedded clays and sandstones of the tertiary. These beds continue high up the south-east face of the Serra de Marába and end uncon-

Section through the Serra de Marába.

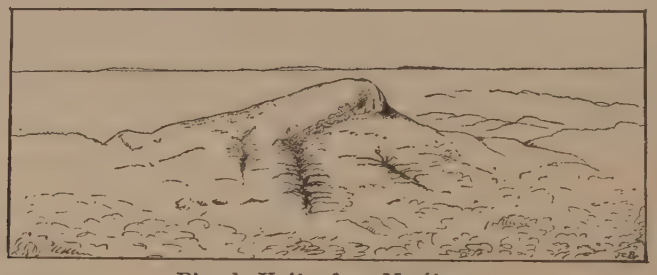
formably against it. They (the tertiary beds) are cut through by the ordinary processes of subaerial erosion, and, if careful search could be made, it is probable that exposures of the cretaceous, or at least of rocks higher than those seen on the summit and face of Marába and lower than the tertiary could be found. At Igreja Nova, a hamlet near the south-east base of the mountain, several loose fragments of compact limestone were found strongly resembling that which occurs near the top of the Itabaiána series, but the rock was not seen in place.

The serra itself, as seen in the few exposures on the top, is composed of light-colored sandstones dipping at an angle of about 40° to the S. E.* These rocks are much jointed, and in many places changed to quartzites. The contact between the paleozoic and

* The slope of the hill where it was seen to correspond with that of the rocks is here given as the dip. The rocks are so metamorphosed that it is difficult or impossible, to obtain the dip directly.

archæan at the base of this serra was not seen, being covered by soil and the talus from the abrupt northern face of the ridges. Not far north of this escarpment the gneisses, such as are seen at the base of Itabaiána, crop out.

From the summit of the Marába and bearing S. 25° W. is another peak of this same range known as the Urubú, shown in the following cut, having the abrupt north-



Pico do Urúbu from Marába.

west face and the south-east dip characteristic of the Marába. From Marába, Propriá on the Rio São Francisco is visible in the distance, and to the left of that place, though far beyond the river, appears a broad plateau with its higher face to the inland side and sloping gradually oceanward, but dying cut in the flat country long before the ocean is reached. This plateau was judged at the time and on the ground to be the continuation of the cretaceous beds of Sergipe in the Alagôas direction.

Fig. F. Pico da Serra Grande from Marába.

Bearing N. 70° E. the Pico da Serra Grande (Fig. F) is the next prominent peak in this range, its beds also apparently dipping south-east beneath the tertiary. Farther away a line of peaks form the north-easterly continuation of this range.

LITHOLOGIC CHARACTERS.

No exposures have ever been found of these Sergipe-Alagôas cretaceous rocks sufficiently continuous to make it possible to determine with any degree of satisfaction whether their lithological characters are constant or otherwise, when long distances or wide areas are taken into consideration.

Without going into tedious details I may say, however, that all the evidence in my

possession points in one direction, namely, that the lithologic characters are not only not constant in these beds, but that they often change very radically within a thousand or two thousand feet.

The oolitic beds, so prominent a feature of the Maroim region, do not appear as such on the Rio São Francisco, where the entire Sergipe-Alagôas series is cut through by the river. The red sandstones of Penedo do not appear as such about Maroim, while they are a conspicuous feature of the geology in the region about Estancia. The shales of Maceio are not seen elsewhere in the basin at any considerable distance from Maceio, and the arenaceous beds of Villa Nova are not known to exist in any other part of the basin.

The rocks vary in texture and character between the following kinds:

1. Coarse, compact sandstone of a bluish-gray color, modified by weathering to brown, and light gray; fossils preserved but difficult of extraction. Example, Riacho de Aroeira.

2. Coarse to fine friable sandstone of open or porous structure; fossils preserved mostly as molds or casts. Example, Coqueiro.

3. Oolitic limestone, bluish and greenish, weathering to light gray, cream-colored and brown. Examples, Urubú, Maroim, at the Gambarobe and Lastro quarries. The brown and cream colors of the oolitic beds are apparently products of incipient decomposition, the bluish and green tints predominating where these rocks are quarried to considerable depths, the brown and cream colors appearing near the surface and where the rocks are penetrated by joints or otherwise made accessible to meteorologic agencies.*

4. Cream-colored, lead-colored and white, soft limestone. Examples, the quarries of Sapucary and Andorinhas.

5. Limestone, more or less compact, without well-preserved fossils, and with flint nodules. Example, Toque below Canna Brava.

*The following is a brief description of thin sections of specimens of these oolitic limestones examined under the microscope:

The body of the rock is made up of irregularly rounded patches of calcite, many of which have the characteristic oolitic structure. There are, besides occasional grains of quartz, a few fragments of greenish mica, and here and there patches of brown hydroxide of iron. All these constituents are cemented together with fine, almost colorless, granular calcite. The oolites are stained a dull brown or cream color, and stand out prominently in the cement. There is nothing unusual in the oolites themselves. They are made up of concentric rings of calcite grains one outside the other, the innermost one usually enveloping a small fragment of organic matter, such as a bit of shell.

Many examples occur among these oolites, however, in which the general mass is not made up entirely of these concentric rings, the formation of these having ceased at a certain point, while beyond this the calcite has been added principally upon one side of the already formed mass, and without any definite arrangement. In some cases two partly-formed oolites are cemented by this amorphous calcite, the united mass retaining the usual irregularly-rounded form In other cases still later formed concentric bands have enveloped the oolites thus united.

THE AGE AND CORRELATION OF THE MESOZOIC BRAZILIAN ROCKS.

Although the mesozoic beds of the region under discussion are here spoken of as cretaceous, the writer is aware of certain conflicting evidence in regard to their age, which should not be overlooked.

Prior to the study of the cretaceous fossils of Brazil by Dr. White, the age assigned to the beds from which these fossils were derived was more or less unsatisfactory.

Although undoubted paleozoic deposits occur in many places in Brazil, no fossiliferous strata have as yet been discovered immediately beneath the cretaceous, while the overlying beds, referred to the tertiary, have never yielded any fossils, and have been so referred solely on account of their relation to the strata underlying them. It is plain, therefore, that the determination of the age of these rocks must be based entirely upon internal evidence, a determination which, on account of the incompleteness of the collections or the want of study, has always been more or less unsatisfactory up to the publication in 1888 of Dr. White's important "Contributions to the Paleontology of Brazil."

Prof. Hartt, in his "Geology and Physical Geography of Brazil," p. 385, says that when, in 1869, the cephalopods collected by him at Maroim were shown to Prof. Alpheus Hyatt, he was at once struck by their jurassic aspect, although in the description of these fossils, which is published at length in Prof. Hartt's book (*op. cit.*, pp. 385–393), nothing is said upon this subject, while they are all said to have come from "the cretaceous beds of Maroim."

Prof. Hartt says (*op. cit.*, p. 393) that the limestone about Maroim is undoubtedly upper cretaceous, though he does not tell us upon what evidence this opinion is based.

The Brazilian cephalopods described by Prof. Alpheus Hyatt in Hartt's "Geology" had been collected by Prof. Hartt from what he considered undoubted cretaceous rocks. Some of these fossils, however, were of decided jurassic affinities, and both their stratigraphic position and peculiar state of preservation warranted Prof. Hyatt in endeavoring to account for their occurrence at such a horizon. Prof. Hartt felt confident that the Sergipe rocks were cretaceous; the fossils were evidently much worn, and had a decided jurassic aspect. Prof. Hyatt therefore suggests* that these cephalopods may have been eroded from beds at a lower geologic horizon (the jurassic) and transported to and deposited in the cretaceous. The suggestion is a natural one for a person unacquainted with the peculiar circumstances under which these fossils occur, but it is only necessary to say here that a knowledge of these circumstances does away with the necessity of this supposition. The fossils were taken from their original beds, and there is no reason for

* Proc. Boston Soc. Nat. Hist., Vol. XVII, p. 370.

supposing that they have been redeposited, as I shall show hereafter, and the case is mentioned in this place only to call attention to what is either conflicting testimony regarding the age of the Sergipe rocks, or to a mingling in them of jurassic and cretaceous faunas.

M. Emmanuel Liais, in speaking of the secondary deposits of Brazil, in his "Géologie du Brésil" (p. 197) says: "Ce puissant dépôt secondaire, tout paraît l'indiquer d'ailleurs, a dû se former pendant au moins une grande partie de l'époque crétacée, et a peut être commencé dès l'époque jurassique, au moins dès la période oolithique. Peu de perturbations auront eu lieu dans ces immenses régions pendant cette longue durée, et par là s'explique comment les espèces du commencement de la période ont pu continuer d'exister et se mêler aux espèces postérieures, de sorte que, suivant la très judicieuse remarque de Darwin, confirmée, comme nous l'avons vu, par l'union d'espèces jurassiques et crétacées dans les divers dépôts du Brésil, les deux époques ne sont pas nettement séparées comme en Europe."

No direct reference, however, is here made to the mesozoic geology of the Sergipe-Alagôas basin. The writer has not been able to locate this opinion of Mr. Darwin, and does not know upon what evidence it is based, but from the limits of his (Darwin's) observations in Northeastern Brazil, it is presumed that such an opinion by Mr. Darwin must necessarily have been based upon evidence accumulated by him in the Argentine Republic and Patagonia.

In his "Contributions" Dr. White gives the following reasons for calling the rocks of the Sergipe-Alagôas region cretaceous (p. 15): "First, the majority of the types are such as are generally regarded as characteristic of that period. Second, a portion of the species are identified with published species of undisputed cretaceous fossils in other parts of the world. Third, although some of the species have a jurassic aspect, none of them are identifiable with any known jurassic species. Finally, as all the collections have been shown to belong to one fauna, and a part of its species to be certainly of cretaceous age, the whole fauna must necessarily be referred to that period." This decision is somewhat weakened, however, by a statement (on p. 6) to the effect that "while such a conclusion would, I think, have been reasonably reached from a study of the fossils alone, much reliance has been placed in the corroborative testimony of the geologists of the Brazilian Survey."

If the members of the former Brazilian survey were now asked to give their reasons for calling these rocks cretaceous, they would lay all stress upon Dr. White's determinations and none at all, or very little, upon any evidence that has been adduced from stratigraphic relations, simply because, as has already been said, those

relations have, as yet, thrown but little or no light whatever upon the age of these particular beds.

In the mind of one acquainted with the mesozoic geology of Brazil, this fact stands forth prominently: that while Dr. White's conclusion that these beds are cretaceous, must be accepted, the fauna presents peculiarities of its own in the jurassic facies of the Sergipe-Alagôas fossils. Another peculiarity of this cretaceous fauna of Brazil is that certain of the typical genera, as Dr. White says, if found alone, would be referred to the tertiary. It may be due to the incompleteness of the collections made, but as far as we know these tertiary forms, Fusus, Murex and Phorus,* occur only in the Pernambuco and Pará collections, and not a single example is reported from the Sergipe-Alagôas basin; while, on the other hand, not one of the jurassic forms is reported from the Pernambuco or Pará beds.

Thus far the writer has spoken of the mesozoic beds of this region as a whole. Let us now ascertain, if possible, whether or not both jurassic and cretaceous beds exist here, and whether this apparent mingling of faunas may not be due to bad collecting.

The Stratigraphic Relations of the Mesozoic Beds.

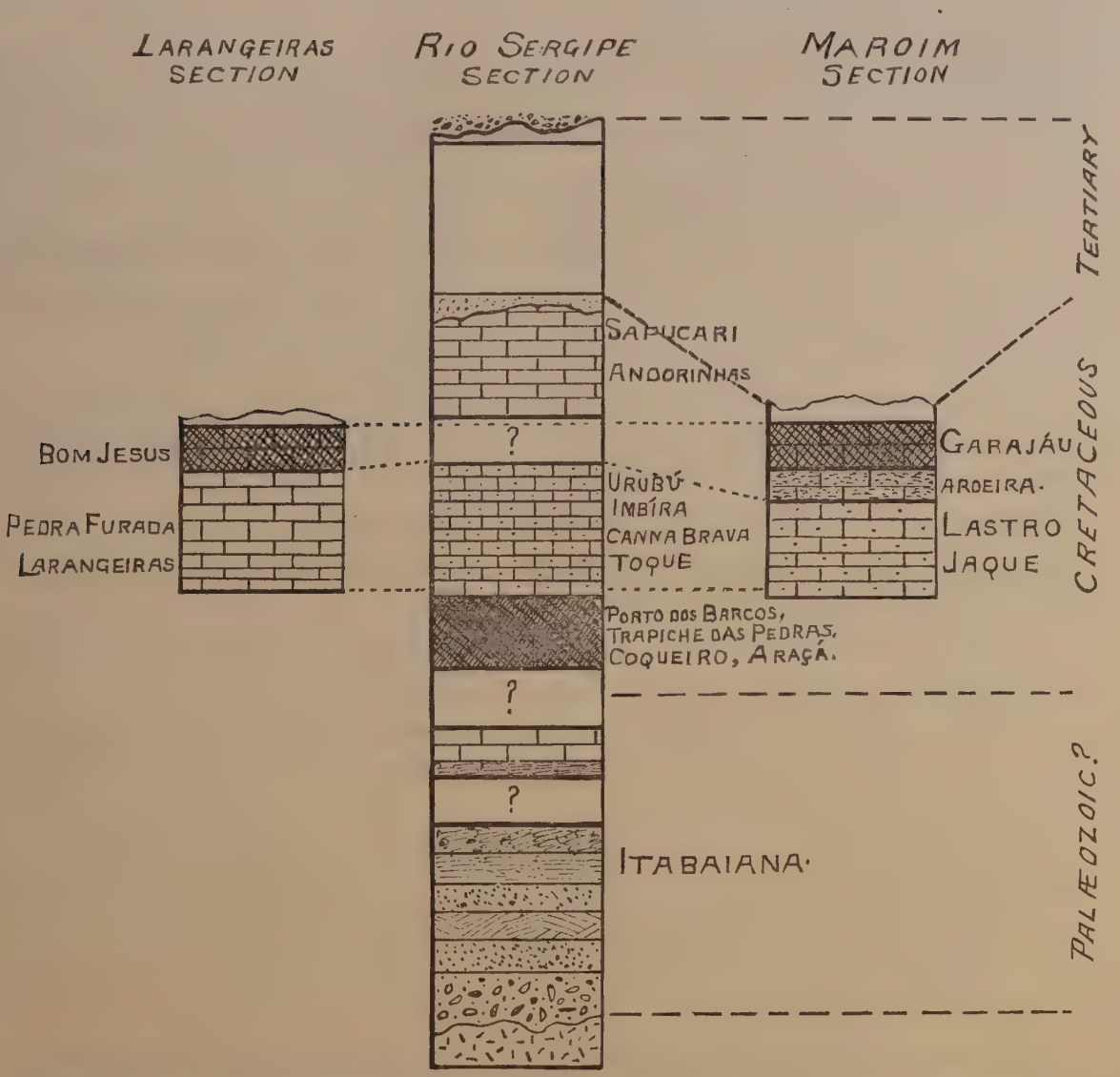
The general relations of the rocks of the separate groups are shown in the section through Itabaiána, and it only remains to indicate the relations of the mesozoic beds to each other. The details of these relations throughout have not been determined with any degree of satisfaction, the time spent in the province having been taken up entirely either in hasty reconnoissance or in collecting fossils. In the few more important instances in which these relations are known they are shown in the accompanying illustrations. In view of the very interesting departure of the fauna of this group from what would be regarded as a typical cretaceous fauna, the lack of detailed information upon this subject is the more to be regretted.

In Prof. Hyatt's paper upon the cephalopods of this region, no definite locality is mentioned for these fossils than "the cretaceous beds at Maroim." I learned from Prof. Hartt subsequently that this collection was taken, almost entirely, from the paving stones in the streets of Maroim. Now the quarries from which these paving stones came are so numerous and at such different horizons, that these fossils cannot be located stratigraphically, and for this reason, no valuable paleontological deductions can be made from them in determining the faunal characteristics and relations of the separate beds in the vicinity of Maroim.

* This statement is made solely upon the authority of Dr. White's opinion as expressed in his "Contributions to the Palæontology of Brazil," p. 17. But inasmuch as Fusus, Murex and Xenophora (Phorus) begin in the cretaceous or earlier, it seems to be of doubtful value.

One of these cephalopods, however, *Ammonites* (*Buchiceras*) *harttii*, Hyatt, as it appeared afterwards, came from the locality known as Bom Jesus. The jurassic aspect of this fossil and the eroded condition of the specimens led Prof. Hyatt to suggest the possibility of its having been transported from some older deposit.

The section given herewith shows the relation of the Bom Jesus beds to others of this group.



Three sections in the Sergipe-Alagôas basin. (The heavily shaded beds yield fossils of jurassic aspect.)

The Bom Jesus beds occur in the hilltops east of the town of Larangeiras. The rocks are earthy, arenaceous limestones which are readily attacked by disintegrating agencies, and have, therefore, been rapidly converted into residuary earths. The

fossils occur, for the most part, lying loose in the road where they have constantly been ridden and walked over, or are imbedded in the black residuary earth that covers these cretaceous hills. In many cases, however, there are irregular blocks of the matrix preserved along with the fossils. The worn appearance of a great many of the specimens from this locality is due to two causes: one is the rapid dissolving action of the rain-water, which when raised to a high temperature by falling upon the hot rocks, attacks them vigorously and leaves an etched surface such as is produced by acid acting upon a calcareous sandstone; the second is the wearing of the rocks against each other where they are constantly walked and ridden over in the road. There is nothing in the rocks themselves, in their topographic position, or in their relations to the underlying strata to lead one to suppose that these fossils have been carried here from a lower geologic horizon.

Attention is called to the relation of the Bom Jesus beds to those of Larangeiras and Pedra Furada, and to the fact that the Larangeiras beds are the equivalents of those of Lastro, etc., at Maroim, and of those of Urubú on the Rio Sergipe.

At Maroim the Lastro beds are overlain by a similar cephalopod-bearing formation, that of Garajáu, which yields other fossils of jurassic aspect, while those of Urubú, the equivalents of the Lastro beds, overlie others of decidedly jurassic facies.

We have then the following arrangement of the strata:

1. At the top are the Garajáu and Bom Jesus beds, yielding fossils of both cretaceous and jurassic aspect.

2. Beneath these are the Lastro, Jaque, Urubú, Imbira, Toque, Capoeira, Larangeiras, and Pedra Furada beds, whose fossils are all referable to the cretaceous.

3. Beneath these are the beds of Porto dos Barcos, Trapiche Maior, Trapiche das Pedras Novo, Trapiche das Pedras Velho, and Coqueiro, all of which yield fossils of both cretaceous and jurassic aspects.

As the jurassic aspect of both the underlying and the overlying beds might tend to throw doubt upon the reference of those of Urubú, Lastro, etc., to the cretaceous, I can only refer to Dr. White's able discussion of this subject in his "Contributions" (pp. 15–16), where he shows that the weight of evidence favors the cretaceous age, not only of those particular beds, but of the entire Sergipe-Alagôas series.

It is no longer cause for surprise that beds of decided jurassic aspects are found overlying others of just as marked cretaceous aspect. Dr. Blanford, in his presidential address before the Geological Section of the British Association at Montreal in 1885, laid timely stress upon these apparently anomalous conditions existing in India and South Africa, and to the grave difficulty or impossibility of an exact and minute

correlation of the beds deposited in such widely separated regions as Europe, South Africa, India, Australia and South America.

It is worthy of note also in connection with the discussion of the mesozoic and tertiary rocks of Brazil that the fossils of jurassic aspect are confined to the Sergipe-Alagôas basin and to the Crato district in Ceará,* while those which have a tertiary aspect are, so far as they have been worked out, entirely from the Pernambuco and Piábas basins.†

Inasmuch as the divergencies between the faunas of the Sergipe-Alagôas basin and the Pernambuco basin tend to associate the former with the older and the latter with the newer geological horizons, the probability is naturally suggested that the Sergipe-Alagôas beds are more nearly synchronous with those of Crato in Ceará which are referred by Newberry and Cope to the jurassic, while the Pernambuco beds are similarly related to those of Piábas in the province of Pará.

THE CONDITIONS ATTENDING THE DEPOSITION OF THE MESOZOIC BEDS.

The rocks represented in the sedimentary beds of the Sergipe-Alagôas sections vary from the coarse conglomerates at the base of Itabaiána and lying in contact with the gneiss, through sandstones, quartzites, shales, slates and dolomitic limestones all of possible paleozoic age. In the mesozoic beds the rocks are sandstones, coarse, fine, and often calcareous. These are variously colored from dark red through brown to cream colored. The limestones are arenaceous, partially crystalline with flint nodules, oolitic and cherty.

The nature of these mesozoic beds indicates that the changes which took place during their deposition were not very great or very sudden. The sandstones lie at or near the base of this series, the oolitic beds follow, and the soft limestones are the highest ones seen.

The order and character of these beds appear to indicate a gradual subsidence of the region from the beginning to the end of the cretaceous. The basal sandstones often contain pebbles the size of a partridge egg, and sometimes the fossils are rolled and water-worn, showing that they were deposited in tolerably strong currents and near the shore. The earthy limestones and oolitic beds which follow indicate an increasing depth and quieter waters, while the uppermost beds have been deposited

*See opinions of Dr. J. S. Newberry and Prof. E. D. Cope concerning the fossil fishes of Ceará in Proceedings of the American Philosophical Society, Vol. XXIII, Jan., 1886.

†See Dr. C. A. White's "Contributions to the Paleontology of Brazil," p. 17, and Prof. E. D. Cope in the Proceedings of the American Philosophical Society, 1886. In the latter paper Prof. Cope compares the Pernambuco vertebrate fossils with those of the Fox Hills (upper cretaceous) of the United States.

in still deeper and quieter water than any of the lower ones, are more homogeneous, and contain the remains of fishes and a few cephalopods. No shallow water animal's remains have thus far been found in them. Then followed the pressure that folded broke, and in places, partially metamorphosed, the cretaceous beds. This ended the depression of the ocean's bottom.

Pressure.—The cretaceous beds of the Sergipe-Alagôas basin have been subjected to more or less pressure, though this pressure has not been uniform.

The following are the evidences of such pressure:

1. Many of the fossils collected in this region are more or less crushed or otherwise distorted.

2. The beds as seen near Maroim, at the Lastro, and at other places along the Maroim arm of the Rio Sergipe, and especially along its western bank, are thrown into folds.

3. Slaty cleavage is noticeable in the Ilha do Chaves, a mile below Propriá.

4. Superinduced cleavage and joint structure are seen in the sandstones of the Serra d'Itabaiána and in those of the Serra de Marába.*

In some localities the limestones are metamorphosed, and their fossils completely obliterated, while in many other places the obliteration of the fossils is but partial.

The folds in these rocks indicate that the pressure by which the region was disturbed came from the south-east. Although this pressure was sufficient to flex the cretaceous beds, and, in places, to metamorphose them more or less, there is nothing to show that it was great. The flexures are usually gentle and the rocks seldom dip at a high angle, as will be seen from the accompanying table of dips.

ECONOMIC.

It is not to be wondered at that the popular notion that precious metals must occur in all mountainous regions, has led to the supposition that the serras of Itabaiána and Marába are auriferous. These mountains have been examined repeatedly in the search for gold, silver and what not, but without success. As long ago as the seventeenth century they were explored and found barren of such riches.† At the

* Certain other sandstones of this region are partially metamorphosed. In some places this metamorphism is complete, while in others it is but slight. There seems to be some doubt as to the exact place of these metamorphosed sandstone beds in the series, but the weight of testimony seems to show that they are tertiary. The metamorphism of these particular beds cannot, I think, be adduced in support of the theory of pressure, for it is entirely due to weathering.

† "Within the jurisdiction of this captainship ('Sergipe del Rey') is the mountain of Tabayana; from whence several valuable ores were presented to the council of 19; but, upon proof, were found not worth farther looking after." 1641. Voyages and Travels into Brazil by John Nieuhoff. Pinkerton's Voyages, Vol. XIV, p. 706.

time when the gold and diamond diggings of Brazil were at the height of their successful operation, extensive explorations were carried on in these mountains. Even during the last twenty years such explorations have not entirely ceased, though they have never given any promise of success.

There is nothing in the geologic structure, as far as it is known, to lead one to expect deposits of economic value in the mountains of Sergipe and Alagôas.

It is possible that from the soft chalky beds at Andorinhas and Sapucary commercial chalk could be manufactured, though I have nothing beyond the general appearance of the rock to lead me to this supposition. It may be worth testing for this purpose. The tertiary beds would yield mineral paints of various red, yellow and brown colors, but owing to the absence of demand for such paints in Brazil, they would have no value at present.

The last member of the tertiary beds, the conglomerate which is scattered far and wide over the region, yields some limonite iron ore, but this ore has not been found in any considerable quantity as yet, and in view of the vast deposits of excellent iron ores in São Paulo and Minas Geraes, it is scarcely possible that a limonite ore could be profitably handled in this part of the Empire.

There were the usual reports through the province, at the time of my stay, of the discovery of coal, silver, copper, lead, etc., but in no case did I find such reports well founded or worthy of serious attention. The coal said to have been found at Campo Redondo was the charred remains of a tree buried in the tertiary clays, while the copper discovered in the same neighborhood was a piece of the manufactured metal.

Building Stone.—The time will doubtless come when the beautiful oolitic limestones of the Rio Sergipe will be utilized for architectural purposes. This stone resembles the famous oolitic limestones of Indiana, so highly prized and extensively quarried and used in the United States for building purposes.

The ease with which the Sergipe rocks can be quarried and sawed and cut into blocks of any size and shape, its hardening upon exposure, its rare beauty, its pleasing tints of green, gray, brown, and cream color, its convenience to transportation by water to Aracajú and thence by sail and steamer to all parts of the Brazilian coast, may yet make it a successful rival of the beautiful crystalline rocks of Rio de Janeiro.

Part II.

THE BRAZILIAN MESOZOIC BASINS OTHER THAN THAT OF SERGIPE-ALAGÔAS.

In order that the relations of the Sergipe-Alagôas basin to the mesozoic geology of other portions of Brazil may be the better understood, brief descriptions are here given of all the other known mesozoic localities in Brazil. The locality in the bay of São Francisco, Province of Santa Catherina is here described for the first time.

SÃO FRANCISCO DO SUL, PROVINCE OF STA. CATHERINA.

Of the cretaceous rocks at this place but little is known at present, and that little is due to a small collection of fossils made here in 1876, by Mr. Luther Wagoner, then topographer on the Imperial Geological Survey of Brazil. As the specimens brought away by Mr. Wagoner were collected incidentally, no observations were made by him of the extent of the deposit, and no one seems to have given the matter attention since that time. The writer visited the place in 1881, but as he was there one night only, he was unable to gain any knowledge of it. The position of the outcrop suggests that this rock may underlie the country about the bay of São Francisco. It certainly does not appear in the surrounding hilly country.

Lithologically it is a brown, earthy, calcareous sandstone resembling that found at Olinda in the province of Pernambuco. It was observed only upon a small island about six miles from the port and covered only about one acre.

The outcrop, Mr. Wagoner tells me, is very inconspicuous, near the water's edge,* and suggests the geology of Bahia and Maria Farinha, except that the exposure is very limited. The specimens collected contained among others a number of fossil gasteropods. It should be stated here that this reference of these beds to the cretaceous is not based upon a detailed study of the fossils, but mainly upon the striking general resemblance of the fossils to those found in the cretaceous beds further north. It is to be regretted that this small collection of material was not submitted to Dr. White in connection with other mesozoic material collected by the Brazilian Survey. Of the relation of the cretaceous at this place to the older rocks nothing is known.

* It was suggested at the time that these specimens might be fragments carried to the place as ballast, but Mr. Wagoner was confident that this could not be the case, for the rocks do not occur in fragments, but in a solid bed.

THE ABROLHOS.

This locality is described by Prof. Hartt in the American Naturalist, Vol. II, March, 1868, and in his Geology and Physical Geography of Brazil, pp. 174–214. It was not visited by the writer, and the following facts are taken from Hartt's writings and from the series of photographs made there in 1876 by Mr. Ferrez, the photographer of the Brazilian Survey. For further details reference should be made to Prof. Hartt's book.

The sedimentary rocks bear a close resemblance lithologically to those of Penedo in the Sergipe-Alagôas basin, and they seem to be referred to the cretaceous largely on account of this resemblance. They are made up of arenaceous limestone (?) beneath, blue shale above, followed by a yellowish shaly sandstone containing obscure plant impressions. These sedimentary beds are covered by igneous rock, and they all have a north-westerly dip at an angle of from ten to fifteen degrees. Neither the thickness nor the superficial distribution of these rocks is given, but both the size and the height of the islands preclude the possibility of either great thickness or extensive distribution.

THE BAHIA BASIN.

The geology of this basin has been written upon by Pissis, Hartt, Allport, Derby, Rathbun, Marsh, Cope, and White. The description and discussion by Mr. Derby, published in the Archivos do Museu Nacional, Vol. III, pp. 135–158, written after the most thorough exploration of the region that has yet been made and with all the facts in hand that had been accumulated by previous observations, is the most nearly complete that has ever been published.

The cretaceous rocks of the Bahia basin were deposited in a fresh-water lagoon, and are therefore quite distinct from those of the cretaceous beds along other portions of the coast. The limits of the basin have never been determined except in a very general way. The following outlines are taken mainly from Mr. Derby's paper above referred to.

The eastern margin of the basin extends from the city of Bahia to the station of Catú on the Bahia and São Francisco railway, a distance of fifty-four miles. The western limits are buried beneath the tertiary hills near Cachoeira and end somewhere east of Nazareth, while the erosion of these tertiary beds gives the margin of the cretaceous exposures a ragged edge, outliers or buttes of the tertiary being scattered here and there throughout the central portion of the area. The northern margin is buried beneath the tertiary plateau which extends from near Cachoeira north of Sto. Amaro,

and crosses the Bahia and São Francisco railway at Pojúca. The south end of the basin has been cut away by the ocean, the island of Itaparica having been included in it.

Near Inhambúpe, about thirty miles north-east of Alagoinhas, Mr. Derby found disturbed beds of schists, sandstones and limestones, which he is disposed to refer to the paleozoic. It is unfortunate that he does not report the dip of these supposed paleozoic beds. While on the Rio Joannes on the east side of the basin he saw the cretaceous lying inconformably against the gneiss.

The cretaceous rocks of the basin are conglomerates, sandstones, shales and limestones. The invertebrate fossils are described by Dr. White in his Contributions to the Paleontology of Brazil.

Of these fossils Dr. White remarks, that "all the types which the fauna embraces, so far as they are determinable, are represented among mollusks now living" and that "a part of these types are at present known to exist or have existed only upon the western hemisphere."

THE PERNAMBUCO BEDS.

The most southerly exposure of the mesozoic beds seen in the province of Pernambuco, by the writer, was near the mouth of Rio Formozo. This exposure, however, seems to be the northern extension, and near the end, of the Sergipe-Alagôas beds, as has already been suggested. But whether it is or is not the continuation of the former, these Rio Formozo mesozoic beds do not pass to the northward of Cabo Sto. Agostinho, along the oceanward side. This cape is of quartz-porphyry,* and on three sides is built against unconformably by particolored tertiary beds of sands and clays, a characteristic view of which is given in the part of this paper treating of the tertiary deposits.† Whether the mesozoic beds underlie the tertiary on the landward

Specimens of the crystalline rocks from the vicinity of Cape Sto. Agostinho, one from Estação da Ilha, collected by Professor Hartt, and two from the island of Sto. Aleixo, collected by the writer, were prepared for microscopic examination and submitted to Dr. George H. Williams, of Johns Hopkins University, Baltimore. Concerning these specimens Dr. Williams writes: " * * They must be described as quartz porphyries or rhyolites, according as they are of pre-tertiary or tertiary age. They are quartz orthoclase aggregates with almost no bisilicate constituents, but their structures are very varied. One of the specimens from Sto. Aleixo has a granular, holocrystalline groundmass of quartz and feldspar, some chlorite, possibly representing original hornblende or mica, and considerable blue tourmaline. The other Sto. Aleixo specimen is a fine granophyre. Porphyritic quartz and feldspar lie in a holocrystalline groundmass which is filled with beautiful spherulites showing the black cross between crossed nicols. The specimen from Estação da Ilha has large porphyritic sanadines with chlorite inclusions which were once glass. The groundmass is mostly composed of rectangular sanadines with much finely disseminated chlorite and iron hydroxide. Magnetite octahedrons and beautiful zircons are abundant. There is no nephelene in any of these rocks.

† See page plate of "The Ruinas de Palmyra."

side of the cape is not known, and it has been assumed that they do not, although there is nothing in the topography of the region to make such connection between the Sergipe-Alagôas beds and the Pernambuco beds impossible.

At Olinda the cretaceous rocks are exposed in the southern face of the hill upon which the church stands. The rocks are soft, earthy, somewhat calcareous, fossiliferous sandstones. This and an exposure of white limestone a short distance west of it, and known as the Forno de Cal, are the only exposures of cretaceous rocks now known in the immediate vicinity of the city of Recife, the next one to the north being in the vicinity of Rio Maria Farinha.

The region, rocks, and fossils of the Maria Farinha beds have been described by Rathbun in his paper upon the cretaceous lamellibranchs,* and by Derby in Dr. White's contributions,† and only such of their characters as may be useful for future comparison with the other cretaceous localities of the coast need be mentioned here. Lithologically the beds vary from cream-colored and white pure limestones to earthy sandstones, all of which dip at a very low angle to the east. They are undisturbed, and none of the beds are oolitic in character. It is to be remarked that, of the several fossils of jurassic aspect in the Brazilian collection described by Dr. White, none have been found at the various Maria Farinha localities. It is also noticeable that all of the genera in this collection suggestive of the tertiary age are represented in the Maria Farinha locality, but none of them have been found at the Sergipe-Alagôas localities. These facts seem to suggest, at least, that the Pernambuco beds are not so old as those of the Sergipe-Alagôas region from which the collections were made.

It is the opinion of the writer, though it is expressed with that hesitation which should come from a lack of sufficient facts to support it properly, that the Maria Farinha and Olinda beds belong to the same horizon as those exposed three miles south-east of Penedo at Villa Nova, and that the latter overlie all the cretaceous beds from which the collections were made in the province of Sergipe.

The extent of the Pernambuco deposits has not been determined, even approximately, and it is not known, perhaps cannot be from surface exposures alone, whether the Olinda beds are, or ever were, connected with those of Maria Farinha, and whether the latter are continued by those found at Iguarassú and Goyanna, or whether those at Parahyba are also a continuation of the Pernambuco beds.

The coast between Olinda and Maria Farinha is low, and there are no rock exposures along it to aid one in connecting the two localities. From near Maria Farinha

* Preliminary Report on the Cretaceous Lamellibranchs collected in the vicinity of Pernambuco, Brazil. By Richard Rathbun. Proc. Bost. Soc. Nat. Hist., XVII, 1874, pp. 241–256.

† Contributions to the Paleontology of Brazil. By C. A. White.

to near the mouth of the Rio Parahyba do Norte the coast is formed of a series of soft, horizontally bedded, particolored tertiary sands and clays which are readily cut and washed away by the ocean, the talus of which obscures any beds which might otherwise appear at their bases.

Cretaceous beds are exposed on the low grounds of the island of Itamaricá, while the tertiary beds form the higher lands.* The relative positions of the cretaceous and tertiary upon this island favor the opinion that these same relations continue northward, and that the cretaceous of Parahyba is simply the northern extension of the Pernambuco beds. It is possible that a careful examination at low tides of the beds along the coast and streams from Itamaricá to Parahyba would settle this question.

No rocks referable to the paleozoic have thus far been found in the vicinity of the Pernambuco basin.

THE PARAHYBA EXPOSURES.

No examination of the mesozoic exposures at Parahyba do Norte was made by any member of the Commissão Geologica, and the only information that we have of them is from a few brief notes by Williamson, Agassiz, and Capanema. The rocks are soft, impure, gray limestones, dipping gently to the east, and containing but few fossils. They occur near the city of Parahyba and at Minas da Cachoeira. Their occurrence at the latter place seems to add to the probability that the Parahyba beds are simply a northerly continuation of the Pernambuco beds.† I have been unable to obtain information regarding the age of the beds immediately underlying the cretaceous rocks of Parahyba.

THE MESOZOIC BEDS OF CEARÁ AND PIAUHY.

Our knowledge of the cretaceous beds of the interior of the province of Ceará is derived almost exclusively from the observations and collections of Gardner made just fifty years ago. With the exception of Capanema, the many writers who refer to these beds have derived their information from him.

The facts of most importance brought out by Gardner are the geological section

* Relatorio dos Trabalhos da Commissão Geologica do Brazil, por Ch. F. Hartt, Rio de Janeiro, 1875, p. 10.

† Among the fossils sent Dr. White from the Museu Nacional at Rio were some broken specimens of *Toxaster altiusculus* White, taken from the walls of the fort at the mouth of the river. As these specimens were collected by myself, I quote from my field notes written at the time, November the 25th, 1875: "I found some echinoderms and shells in the walls of the old Dutch fort, at the mouth of the Rio Parahyba, but upon inquiring for the quarry from which the stone came, I was told that it was brought from Europe; at least that there are no quarries in the neighborhood yielding such stone."

of the Serra do Araripe, which, beginning at the base, consists of horizontal beds of lignite, limestone, sandstone, with chalk and flints, the sandstone stratum forming the mass of the plateau. The total thickness of the section is from 1200 to 1500 feet. The underlying rock appears to be slate, presumably paleozoic. The fossil fishes found occur in concretions scattered about the surface, which he supposed to have been water-worn. The exact position of the fossils in the section is not known. Gardner believed them to have been weathered from the sandstone bed, but Hartt, who, however, never visited the locality, expresses the opinion that they come from a bed beneath the sandstone, which he thinks, together with the overlying beds, belongs to the tertiary. The serra here spoken of trends N. N. E., and is an elevated plateau about thirty miles wide, cut down rather abruptly on both sides, the valley on the Ceará side being lower than that on the western or Piauhy side. The geographic distribution attributed to these beds by Gardner, that is, from this point to Maranhão, is not warranted either by the facts given by him, or by any that have subsequently come to light. The fossil fishes collected at and about Crato, by Gardner, were described by Agassiz, who believed them to be of cretaceous age.* It should be mentioned in this connection, however, that Dr. J. S. Newberry and Dr. E. D. Cope regard these fishes as of jurassic age.†

OTHER CRETACEOUS EXPOSURES.

Rio Mossoro, Province of Rio Grande do Norte.—The exposure of the cretaceous on the Rio Mossoro in Rio Grande do Norte was reported by Major Coutinho. Nothing is known of the character of the beds or their geographical distribution. *V.* Dr. White's Contributions, p. 10, foot-note.

Rio Piábas, Province of Pará.—Concerning the Piábas locality I personally obtained from Snr. Ferreira Penna substantially the same information as that furnished Professor Hartt, and given in Dr. White's Contributions, p. 9. Snr. Penna assured me, however, that he had never seen these rocks exposed elsewhere than at the mouth of the Rio Piábas where they are uncovered at low tide. He found the exposure while making a trip along the coast in a small boat, and spent but a few minutes in making the collection from which Dr. White describes so many species.

Rio São Francisco above the Falls of Paulo Affonso.—The secondary nature of some of the rocks of the São Francisco valley above the falls was first made known

* Edinburgh New Philosophical Jour., Jan., 1841.

† A Contribution to the Vertebrate Paleontology of Brazil. By E. D. Cope. Proc. Am. Phil. Soc., January, 1886, pp. 1–21. The opinion of Dr. Newberry is quoted as here cited. It should be stated, however, that there is possibly a mistake in crediting him with this opinion, for in a recent conversation with the writer, Dr. Newberry referred to these fossils as of cretaceous age.

by Mr. Derby in his article published in the Archivos do Museu Nacional, Vol. IV, for 1879 (published in 1881). These are horizontal beds exposed in the isolated hills which extend along the left bank of the river from near Piranhas to Itaparica, but they form more continuous chains from the serra de Tacaratú toward the interior, while what appear to be plateaux of the same rocks stretch away to the south of the river also. In the immediate neighborhood of the river they are continuous from near the mouth of Pajeú to Itaparica. Above Pajeú, hills, apparently of these same rocks, stand back from the river and overlie the gneiss. These beds contain silicified wood in abundance, besides a few other fossils. At a place called Atalho, fossil cyprids, bones, teeth, and scales of fishes and of reptiles have been found. At Caissara several leagues further up the river these beds occur again.

The only determination of any of these fossils made by Mr. Derby was that of scales of *Lepidotus*. He ventures the opinion that they are secondary and probably cretaceous, resembling somewhat the fresh-water cretaceous of Bahia.

I regard the discovery of these deposits by Mr. Derby as one of great importance in the study of the mesozoic geology of Brazil, for this locality seems to furnish the facts necessary for the determination of the relations between the coastal beds of the Sergipe-Alagôas region and the interior, and somewhat more elevated, beds of Ceará.

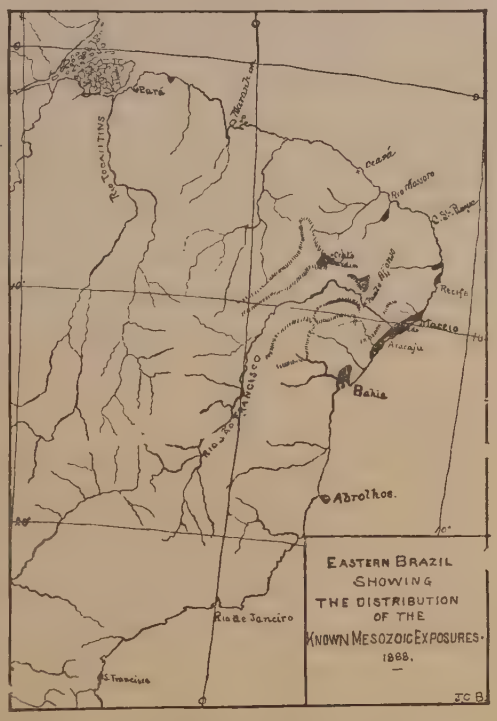
Rio Purus, Valley of the Amazonas.—The only unquestionable cretaceous deposits thus far known in the Amazon valley are on the Rio Aquiry, an affluent of the Rio Purús. These deposits were discovered by Chandless and are very briefly described by him in an article published by the Royal Geographical Society, Vol. XXXVI, p. 119 *et seq.* The Aquiry enters the Purús on the right in latitude 8° 45′ South, longitude 67° 23′ West. From the mouth of this stream to 11° South latitude the water, when low, uncovers rocks in the middle of the stream, in which fossils are found. Vertebræ from these beds were seen by Agassiz at Manáus, and he pronounced them to be those of Mosasaurus. Nothing is known of the general character or extent of these beds. The theory that the cretaceous outcrops around the rim of the Amazonian basin is not supported by any known facts.

CORRELATION OF THE MESOZOIC OF THE COAST AND THE INTERIOR.

Owing to the lack of knowledge of details a very brief discussion of the relations of the mesozoic beds along the coast with those of the interior is undertaken with much hesitation. Indeed, were it not that this subject has already been touched upon by Mr. Derby in such a manner as to lead geologists to suspect that we have here unusual and very peculiar conditions, it would not be attempted at all.

It will be observed upon the small map on this page that, besides the small basins along the Brazilian coast, there are, leaving the Purús exposures out of account, two mesozoic localities at some distance from the coast, one at and about Crato in Ceará, another about Tacaratú, a short distance above Paulo Affonso, in the valley of the Rio São Francisco.

The cretaceous beds of the Sergipe-Alagôas basin overlie paleozoic rocks, those of the São Francisco basin appear to overlie metamorphic rocks, which may be either paleozoic or archæan, while the Ceará beds overlie slates which are probably paleozoic. The region separating the Sergipe-Alagôas exposures from those of the São Francisco basin are granitic and metamorphic, while metamorphic rocks lie between the Ceará exposures and the sea coast. If we take into consideration the cretaceous basin of Bahia we find that also separated from the exposures of the São Francisco basin by crystalline and metamorphic rocks.



Gardner reports fossil fishes in the vicinity of Jardim, a town south-east of Crato. The serra de Tacaratú on the northern side of the Rio São Francisco above the falls of Paulo Affonso is said by Mr. Derby to be composed of rocks of secondary age. This serra is about one hundred miles south-east of Jardim, but Mr. Derby says* that "these secondary deposits become more continuous and form a long line of hills, which beginning with the serra de Tacaratú stretches away into the interior of the province of Pernambuco." The intervening country has not been examined, but it seems highly probable then that the Tacaratú beds are the southern extension of those of Crato and Jardim.

As nothing is known of the details of the mesozoic geology of the Mossoro basin, nothing can be ventured regarding it further than that its proximity to the Crato exposures naturally suggests that the beds of the two localities are identical, the intervening beds having, in all probability, been removed by erosion.

Mr. Derby intimates that there is something peculiar about the relations of the coastal mesozoic beds to those of the interior. The objection offered by him to the correlation of the Ceará and the São Francisco valley beds with those along the

* Archivos do Museu Nacional, Vol. IV, p. 92.

coast, namely, that they stand at different elevations, reduces itself to the suggestion of a classification of geological formations by comparative elevations.* If all the beds of the cretaceous both upon the coast and the interior were found to be perfectly horizontal, with no evidences of faulting between, we might possibly be justified in such an assumption. The position of the Sergipe-Alagôas beds, however, shows that this is not only not the case, but that in this basin, at least, the beds have a very decided dip toward the ocean, while their inland margins rise to a height of from 400 to 500 metres or more where they overlie the paleozoic beds of the Itabaiána. At their inland margins they rise to the same elevation above a large number of exposures of the same beds at tide level near the coast. If no connection had been traced out between these Sergipe localities we should be obliged, according to this hypsometric classification, to separate these beds geologically. This suggestion must be regarded, therefore, as a geological *non sequitur*. Mr. Derby assumes also that the coastal cretaceous beds do not reach an elevation greater than 100 metres above tide. This is erroneous. The serra of Itabaiána is, according to Mouchez, from 700 to 800 metres above tide, and the cretaceous beds overlie the paleozoic beds of Itabaiána to within 150 metres of its summit, which would make the elevation of the cretaceous at this place above tide about 600 metres.

According to the elevations along the Rio São Francisco, determined by Col. W. Milnor Roberts, the river near Tacaratú and in the vicinity of the secondary beds reported by Mr. Derby, is 320 metres above tide, and, according to him, the hills to the north are about 300 metres above their bases,† or, say 620 metres above tide.

The Ceará beds, according to Gardner, rise to an elevation of 600 metres above tide, which would also indicate that, as far as elevations are concerned, there is no important difference between the interior and the highest of the coastal deposits. But I lay no stress upon this elevation of the coastal beds, for, to my mind, it is a matter of but little importance, and I return to my original statement, that even if there were very marked differences of elevation, nothing could be deduced therefrom in regard to the relative geologic ages of the beds of the various localities. The elevation of the Brazilian coast has not been an even one, and there is certainly no reason for supposing that it would be. The elevation or depression of coast lines, and especially of lines as long as that from Rio de Janeiro to the mouth of the Amazon, has seldom or never been known to be even or regular. It is true that the tertiary beds along the Brazilian coast have a generally horizontal position, but this appear-

* "It is difficult to admit the contemporaneous deposition of beds at such different elevations," Archivos do Museu Nacional, Vol. IV, p. 94.

† Archivos do Mus. Nac., 1879, Vol. IV, p. 91.

ance does not conflict in any respect with the idea of unequal elevation, for this elevation would need to be very unequal indeed to make itself perceptible to the unaided eye.*

All of the little evidence we have seems to suggest the identity of the coastal with the inland beds—certainly it does not suggest any obstacle to their correlation.

Agassiz pronounced the fossil fishes, collected by Gardner, cretaceous, while Newberry and Cope believe them to be of jurassic age. Dr. White pronounces the majority of the Sergipe-Alagôas fossils to be cretaceous, though he and Prof. Hyatt declare many of them to have a jurassic aspect. If these facts suggest anything in regard to the relations of the rocks to these localities, it is that the probabilities favor their, at least, approximate identity. While I cannot, of course, maintain this correlation, I must, at least, dissent from a separation without better evidence than has thus far been adduced.

*See Géologie du Brésil, par Emmanuel Liais, p. 249.

Part III.

THE TERTIARY.

The thorough understanding of the tertiary geology of Brazil, not to say of South America, would, in my opinion, be of more interest and value to geology than that of any other geologic horizon represented on that continent. A full discussion of it cannot be undertaken here, is not intended, and indeed would be impossible without a vast amount of field work. The formation is too widespread and the questions presented by it too complicated to admit of discussion in this place, further than it relates to the geology of the Sergipe-Alagôas basin and to the cretaceous formations of the eastern coast.

In Brazil this formation is represented by horizontal beds of sands and clays forming a system of marine terraces from 100 to 250 feet thick, extending from somewhere between Rio de Janeiro and Bahia more or less continuously along the coast to the north, being especially prominent from about Maceio nearly to Cape St. Roque. In the Amazon valley they form the table-topped hills and are widespread from the Rio Araguay westward. The beds of the Amazon valley were thought by Agassiz to have been deposited in an inland lake during the glacial epoch. Pissis says that the marine tertiary beds of the coast are represented in the interior by beds of lacustrine origin. The origin attributed to the tertiary by Prof. Agassiz need not be discussed, as in all probability no one now admits its correctness, while a lack of knowledge of the lacustrine deposits of the interior renders the discussion of the theory of Pissis impossible. It must be admitted, however, that this theory of Pissis is a very plausible one, and such observations as the writer has made upon the geology of the interior of Brazil leads him to accept it as a favorite working hypothesis. In none of the supposed tertiary beds of the interior, at least in the provinces of Rio de Janeiro, Minas Geraes and Matto Grosso, has the writer found unquestionable evidence of the tertiary age of such deposits.*

Character of the Beds.—The general features of the Brazilian tertiary have been several times described by such good observers as Agassiz and Hartt. The uniformity

*Since the above was written a letter, making inquiry concerning the tertiary, has been directed to Mr. James E. Mills, of San Francisco, Cal., who has traveled in many parts of the interior of Brazil. In reply Mr. Mills says: "I cannot give you any definite information from my notes about the tertiary deposits in Brazil, because in Rio Grande do Sul, Minas Geraes, Rio de Janeiro, and other parts of the country where I had opportunities for observations and study, there are no deposits which I know certainly to be of tertiary age."

in its general characters between such widely separated regions as the Amazonas and Sergipe or Bahia is worthy of note. The description by Hartt of the tertiary hills of Parauaquára* might have been written of some of the Sergipe exposures with the exception of the sequence of the various beds. The following is his section, beginning at the top:

1. A few feet of fine, light, brick-red earth, consisting of a mixture of clay and fine sand.
2. Red sandy clay with iron nodules.
3. Tauatinga clay, grayish-white. Heavy bed, not laminated.
4. White clay, partly pure tauatinga, partly sand, resembling brick of two imperfectly mixed clays. Bakes hard in the sun and resists denudation.
5. White or cream-colored, soft, fine-grained sandstones.
6. Variegated sandy clay.
7. Argillaceous sandstone variegated with bands and mottlings of delicate shades of white, red, purple, brown and yellow.

The following section was observed near Maroim, and may serve as a type of this formation along this part of the coast:

1.	Surface soil, sandy,	4 feet.
2.	Mottled red and white clays,	3 "
3.	Brown sandstone,	1 foot.
4.	Chalky above, red beneath,	6 feet.
5.	Terra-cotta colored sandy clays,	7 "
6.	Dark red, hard clays,	2 "
7.	Soft, light-brown sandstone,	3 "
8.	Soft white sandstone,	10 "
9.	Soft earthy sand,	1 foot.
10.	Talus, principally from No. 7,	15 feet.

Not enough attention was paid to the tertiary to enable the writer to say whether the sequence of the beds is at all uniform even within the limits of the Sergipe-Alagôas basin.

Evidences of the Age of this Formation.—The series of rocks here referred to the tertiary are so called upon stratigraphic evidence alone, for it is a very remarkable fact in regard to these beds that, widespread as they are, no fossils have ever been found in them, though diligent search was made for them by the writer, and doubtless also by others. But their relations to the cretaceous and their general resemblance to the tertiary beds of other parts of the world scarcely leave any doubt about the

* Bul. Buf. Soc. Nat. Sci., Jan., 1874.

correctness of this reference. What portion or portions of the European or North American tertiary they represent it is quite impossible to say. In general appearance the deposits bear a strong resemblance to some of the later tertiary formations of the Southern United States, though the materials of the two are derived from very different geologic sources.

Absence of Fossils.—It is a peculiar feature of the Brazilian tertiary that with the exception of a few plants found in the Amazon region, fossils have never been discovered in it. That fossils should not be preserved in beds of such thickness and wide distribution, made up of strata of sands and clays variously commingled, is certainly to be wondered at. The statement of the fact has often been questioned, and explained by the assumption that careful search has not been made for them. That they may yet be found is of course highly probable, but the writer has searched miles of exposures in vain for any recognizable trace of organic remains.

Several hypotheses suggest themselves in explanation of the non fossiliferous character of these rocks. After examining the geology of the Amazon region, Agassiz concluded that an enormous glacier once moved down that valley, and built up across its eastern end a gigantic moraine; that as the ice melted the formations which are now believed to be tertiary were deposited from the cold, muddy waters flowing from the glacier into a great lake. This, to his mind, explained also the absence from these beds of organic remains other than leaves. But even if Prof. Agassiz's theory of the origin of these Amazonian beds were accepted* it would not explain the absence of fossils from the same rocks along the south-eastern coast of Brazil.

Two hypotheses are offered: The first is, that these rocks were deposited so rapidly, and from water so overloaded with mechanically suspended matter, that animal life in them was impossible. It may be said in regard to this theory that while most of the tertiary beds are of a nature which would support it, there are many beds of clays and very fine sands which would hardly be deposited rapidly or from strong currents (see section on p. 410).

The second hypothesis is that these beds once held organic remains, but that they have been dissolved out by infiltrating waters.

Present Extent of the Tertiary.—The present distribution of the tertiary beds in the Sergipe-Alagôas basin cannot be given except in general terms, but from the explanation of its relations to the cretaceous rocks of the region (*v.* p. 376) one will

* Agassiz's theory has never been accepted by the geologists who are acquainted with the geology of the Amazons, and he is said to have abandoned the theory of the glaciation of Brazil before his death. See Glaciers, by Shaler and Davis, p. 47.

have no difficulty in knowing what is to be expected. It is much more widespread through the western than the eastern portion of the province of Sergipe, while in Alagôas it is represented by a succession of mutilated terraces. In the western part of Sergipe the dry, thirsty soil of this formation prevents the growth of important forests, and gives to it the name of *agreste* in distinction from the wooded cretaceous soil of the eastern portion.

Near the coast, along the São Francisco river and the other larger streams of the region, there are scarcely any remnants of the tertiary to be seen, but as one recedes from the valleys, outliers of the tertiary become more and more common until it forms continuous taboleiros, deeply gashed at their margins and sometimes abutting unconformably against the paleozoic or cretaceous rocks of the serras. On the sketch map on page 386 the outliers of tertiary in the vicinity of Aracajú and Maroim are located approximately. The tertiary hills are, as a rule, characterized by having flat tops. It not infrequently happens, however, that small outliers have been so extensively eroded that the upper and most resisting bed of clay has been washed away and the lower beds have broken down rapidly, leaving a more rounded and less characteristic topography.

Toward the northern end of the basin the tertiary beds approach nearer and nearer the coast, until, north of Maceió, they form a chain of hills and bluffs which continue with occasional interruptions to near Rio Grande do Norte.

The Original Extent of the Tertiary.—The original extent of the tertiary beds is indicated partly by the horizontality and the approximate uniformity in thickness and character of the strata, and, secondly, by the distribution of the existing remnants.

A satisfactory statement of the original limitations is not possible with our present knowledge, because we are ignorant of and have no means of determining the amount of erosion that has taken place from the upper surface of these beds. It is evident, however, from the continuity of the lithological characters of preserved beds where exposed over wide areas, that the strata were originally continuous over the whole of the lower parts of the Sergipe-Alagôas basin, and over many of its considerable elevations as well.

It is easy thus to calculate a part of the erosion that has taken place, but in view of the impossibility of knowing the original thickness of these beds, we cannot make a trustworthy estimate of the whole. It is a noteworthy fact, however, that in the Sergipe-Alagôas basin the remnants of the tertiary beds do not extend beyond the limits of the cretaceous basin into that of the crystalline rocks. They end unconformably against the beds of the Serras d'Itabaiána and Marába, and only

where the cretaceous beds are not limited on their inner margins by such ranges do they rest upon or against the crystalline rocks.

Denudation.—The present distribution of the tertiary, the horizontality of its beds, and the high angles of their exposed margins, all go to show that the denudation of these rocks has gone on and is still going on at a rapid rate, whatever the causes. Erosion and denudation are still in progress, and some of the causes, at least, may be studied upon the ground. The tertiary beds frequently form broad, dry, and sterile plateaux or table lands known in Brazil as "chapadas" and "taboleiros." In places these plateaux are almost barren of vegetation, and are deeply scored with gullies, ravines, and gorges as much as two hundred feet in depth. Such spots are quite common about the margins of these plateaux. It is not an uncommon thing, however, for hills having more or less vegetation over them to yield to erosion and to develop such cases as that shown in the accompanying illustration of the "Ruinas de Palmyra," near Cabo Santo Agostinho. This case is a typical one (*v.* Plate III). One is often struck, on looking at these rapidly cutting exposures of tertiary, with their resemblance in miniature to the topography of parts of the Grand Cañon region of the United States.

The great denudation of the tertiary beds is due to the following five principal causes:

I. The impenetrability of the surface clays.

II. The sterility of the soil resulting in barrenness of vegetation, and the absence of the protection arising therefrom (*v.* p. 376).

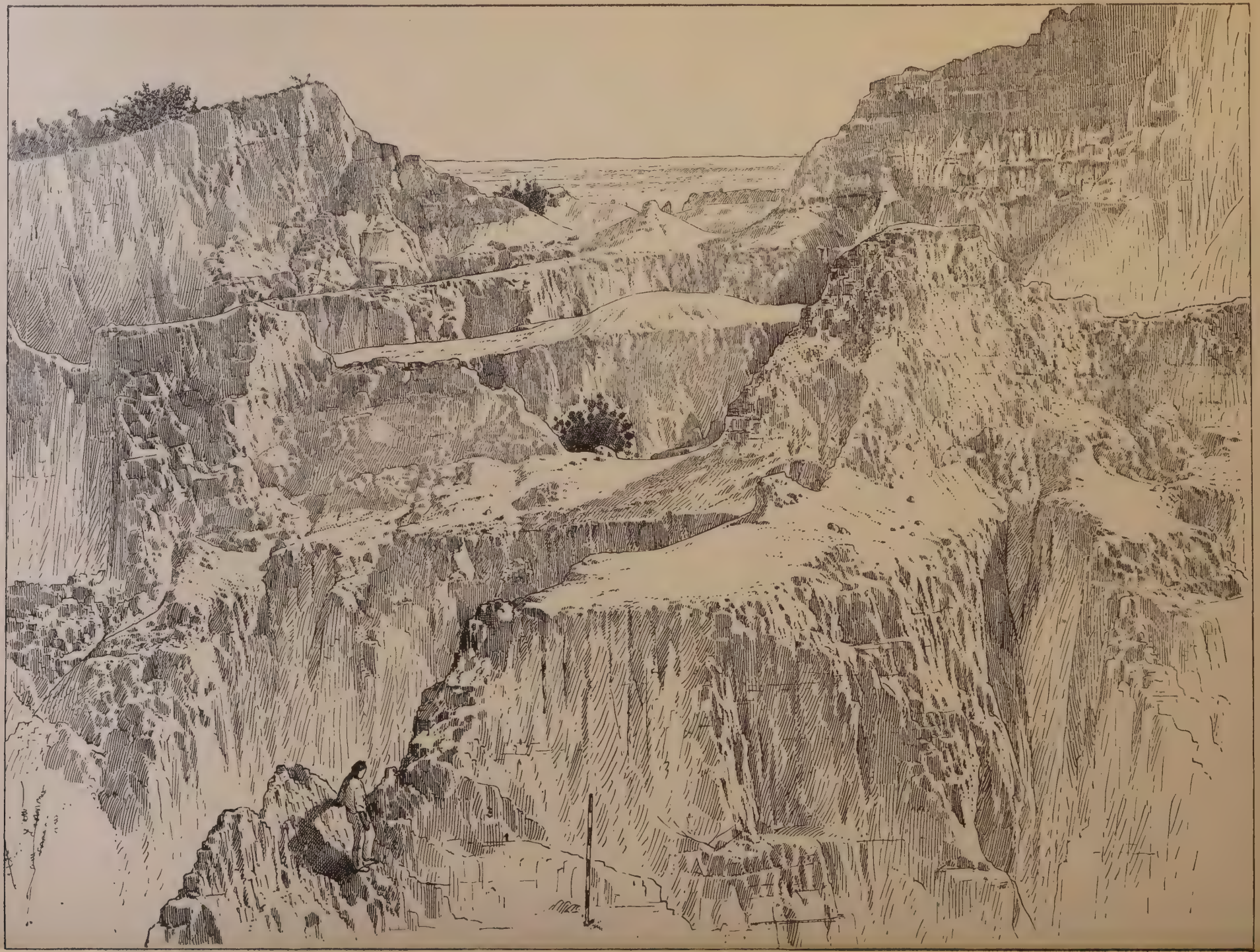
III. The unresisting nature of the rocks (*v.* p. 410).

IV. The great precipitation concentrated within a few months of the year increasing in geometric ratio the abrading and transporting powers of the water.

V. The temperature of the water considerably elevated by falling upon the bare hot surface clays.

I shall speak of these causes in their order. (I) The impenetrability of the soil prevents the precipitation from soaking into the ground, obliges it to seek its level along the surface at once and is therefore conducive to floods and to corrasion. The tertiary clay through this region being more or less impenetrable, sheds its water almost perfectly, and thus hastens erosion by floods and freshets whose abrading and transporting powers are enormous.

It will be observed that in almost all the descriptions of Brazilian tertiary sections there are alternate sandy and clayey beds. When erosion acts readily upon the sandy ones they are soon removed until a bed containing sufficient clay to turn the water readily is reached. This bed then becomes the surface clay of the country



shedding the great precipitation of the region and sending it in powerful torrents down the soft margins of the formation whence enormous quantities of earth are swept away.

(II) The sterility of the soils derived from the tertiary is notorious. This sterility is due largely to the tendency of the surface clays to turn the rainfall instead of allowing the water to soak into the ground. But little water is able to penetrate the ground, and for this reason dry weather is invariably fatal to crops in tertiary soils. The natural vegetation is remarkably scant, except in the deep ravines. The wiry grass, stunted trees, and cacti that grow over these sterile plateaux, or "chapadas" as they are called, offer but little resistance to the water flowing from the surface.

(III) In the description of sections in the tertiary it may be seen that there are no beds in the whole column capable of long resisting the ordinary processes of subaerial erosion in the tropics. The beds are usually clays and sands variously commingled. I have seen but one indurated rock in the series—a very hard, glassy quartzite, metamorphosed in weathering, but this rock does not appear to form a continuous bed at any one place, or to occupy a definite position in the series. In such soft and easily eroded material the heavy rainfalls of Brazil do the greatest possible amount of work.

(IV) *Precipitation.*—That precipitation in the tropics is not as evenly distributed through the year as in temperate regions is a well-known fact.

In Brazil the year is divided as naturally into rainy weather, "*tempo de chuva*," and sunny weather, "*tempo de sol*," as in temperate regions it is divided into winter and summer; but it is important to note also that the rainy season is the hot season, the "*tempo de sol*," referring to continuous sunshine.

The rainy season does not set in at the same time in all parts of the country, but may begin one, two or three months later or earlier in one place than in another. This, however, does not affect the general results. One of the best records of rainfall in Brazil of which I have knowledge is that kept by the St. John del Rey Gold Mining Company at Morro Velho, in the province of Minas. This record covers the period from 1855 to the present. A resumé of these observations published in 1880 shows* the average annual rainfall up to that time to be 1637 millimetres, and that 89 per cent of this, or 1457 millimetres, fell during the six months from October to March inclusive, while from April until September only 180 millimetres fell.

A series of observations kept at the city of São Paulo during the year 187.†

* See "Relatorio de W. Milnor Roberts sobre o Rio São Francisco," Rio de Janeiro, 1880, and *Revista de Engenharia* for May, 1880.

† *The Rio News*, February 5, 1880.

shows that out of the total rainfall of 1287 millimetres during the year, 1152 millimetres fell from November to April inclusive.

Observations made during 1881 at São Bento das Lages in the province of Bahia give a total precipitation of 1984 millimetres for the year, of which 1439 millimetres fell from March to August inclusive.*

Observations made at Uberába, province of Minas, from 1880 to 1882 inclusive, show an average annual precipitation of 1561 millimetres, of which 1264 millimetres fell from October to March inclusive.†

Records of the rainfall in Ceará during the twenty-eight years from 1849 to 1876 show an average precipitation of 1346 millimetres during one half the year, against 143 millimetres during the other half.‡

These examples are sufficient to give a correct idea of the distribution in time of the precipitation in Brazil. A rainfall so unevenly distributed cannot fail to do an unusually large amount of erosion.

On the whole, however, the erosion of these tertiary beds does not appear to be going on so rapidly as formerly, and indeed I am not disposed to believe that the extensive denudation of the tertiary beds which has taken place in Brazil is to be attributed to subaerial erosion alone. It seems probable that the greater part of this work was done at the time of and immediately after the emergence of these beds from beneath the ocean, while the beds were even softer than at present, and before the surface was taken possession of by vegetation. In many places over the tertiary region where the country is thickly clad with vegetation, erosion is practically *nil.* The great width of many of the valleys and the precipitous faces of the tertiary ranges that border them suggest that these hills faced the ocean, or were the shores of bays during the time of the land's elevation from beneath the tertiary seas.

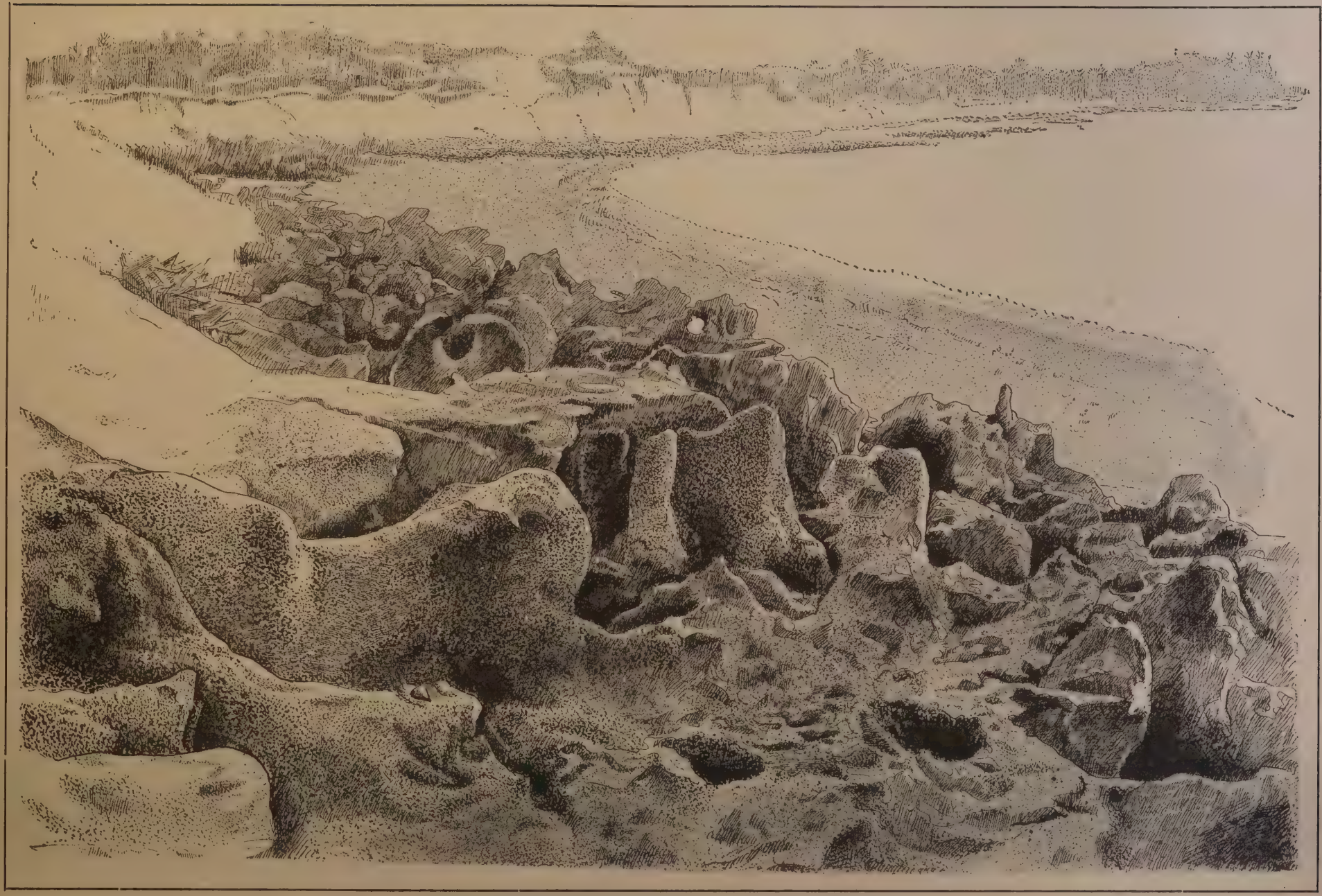
At many places along the Brazilian coast the ocean is also attacking these tertiary beds upon the edges, undermining them and spreading the material of which they are composed over the ocean's bottom. The bed of the ocean north of Rio de Janeiro is, in most places, covered, not with the glauconite ooze usually found along the shores of continents, but for the most part with red mud carried down by the streams, or washed away directly by the waters and undertow from the soft red tertiary rocks of the coast.§ The red cliffs, so noticeable to one sailing along the coast in sight of the shore, are all tertiary, and wherever the water breaks against the bases of these cliffs, they are being rapidly cut away.

* *V. Revista de Engenharia* for May, 1882.

† *V. Revista de Engenharia,* Vol. V. (1883), p. 251.

‡ *V.* Ensaio Estatistico de Pompeu de Souza Brazil, p. 105 (in part).

§ *V.* Challenger Reports; Narrative, Vol. I, Part I, pp. 215–217.



A Beach of Tertiary Sandstone, Rio Formozo, Province of Pernambuco.

The greater portion of this red mud is derived directly from the cliffs along the shores where the ocean is a more direct agent of erosion, transportation and distribution of this material than the streams themselves. I make this statement advisedly. The streams of the region do not now, as a rule, have sufficient current to be such powerful agents of transportation as they formerly were. In the lower portions of their courses they have generally cut down to or near their base levels, and are therefore comparatively powerless. During the season of rains the finer sediments are washed from high grounds into all the streams, but the Rio São Francisco is the only stream flowing into the ocean in Brazil south of the Amazon, which brings down any considerable quantity of sediment. Such streams as the Sergipe seldom carry muddy waters into the ocean, the material brought in suspension from the higher country being precipitated near the head of tide water, which is usually miles inland.

It happens that nearly all these tertiary beds have already been worn away from the immediate neighborhood of the ocean in the Sergipe-Alagôas basin. They are well exposed, however, along the coast between Maria Farinha and Parahyba in cliffs, some of which are more than four hundred feet in height.

In a few places tertiary beds are exposed along the ocean's beach, having no considerable thickness of their own formation overlying them. In such places they offer more than the usual resistance to the encroachment of the sea, and though the beds are by no means hard, they are worn into fantastic forms by the surf. An example of this kind is shown in the plate illustrating the erosion of a tertiary beach near Rio Formozo in the province of Pernambuco (*v.* Plate IV).

Horizontality of the Beds.—These beds are, everywhere I have seen them, so nearly horizontal that no dip is apparent. Exposures have been seen where the beds appeared, at first sight, to have dips as high as twenty degrees, but upon closer inspection they have turned out to be delusive. In other places the writer has seen steep dips caused by the caving and tumbling down from banks of fragments so large that they might easily deceive the observer into believing them true dips. Pissis gives three examples of dips in the tertiary, one of which is as high as 15°.* The cases cited are possibly delusive ones, such as are referred to above.

Metamorphism in the Tertiary.—The fact that there are compact, glassy quartzites among these tertiary beds might, if taken alone, lead one to surmise that this formation had undergone dynamic disturbances. Such, however, is not the case. These quartzites seldom or never occur forming beds continuous over considerable distances, but are derived from soft beds of sandstone which become indurated here

* Mémoire sur la position géologique, etc., p. 467.

and there upon exposure, forming quartzite blocks. As the surrounding portions of the beds weather away, these blocks are usually left lying loose on the surface where they exfoliate somewhat under the same influences that hardened them. That this metamorphism is produced by weathering scarcely admits of doubt. The beds which are metamorphosed are high up in the tertiary series, the underlying beds being made up of soft horizontally stratified beds of clays and sands. It is quite evident that these rocks have not been subjected to any unusual lateral pressure, such as that which so often produces metamorphism. The pressure from above is and always has been less than that upon the underlying soft beds of sand, so that its metamorphism cannot be attributed to pressure from above. The strongest evidence that this metamorphism is a process of weathering is found in the condition of some of the partially metamorphosed masses of sandstone. The writer has seen at three separate exposures large masses of this glassy quartzite protruding from banks of soft sandstone, which, upon being broken off two or three feet beneath the face of the exposure, showed the uncovered end of the block to be nothing more than sand in process of hardening, the mass becoming harder and harder toward the exposed surface. When these blocks are entirely separated from their surroundings and lie fully exposed to sunshine and rain, they become as hard as glass and have a similar conchoidal fracture. Heated as they usually are by the direct rays of the sun during the day and cooled by radiation at night or by cool rains, their angles exfoliate until they are almost perfectly round. Prof. Hartt at one time thought that these boulders were brought to this region by glacial action. Although these quartzites are tertiary, there are occasional quartzitic beds in the cretaceous also, yet there is but little danger of confounding them; those of the tertiary being barren of fossils, while those from the cretaceous usually contain a few fossils. The hard cretaceous sandstones in the Riacho de Aroeira approximate in general appearance to the tertiary quartzites. It would not be safe, however, to assign all the non-fossiliferous quartzites of this region to the tertiary, for some of the cretaceous sandstones have been sufficiently porous to allow percolating waters to dissolve out the fossils, and subsequently they have been changed to quartzites. I find in my notes the opinion expressed that a certain bed of quartzite more or less buried beneath black cretaceous limestone soils, is cretaceous, and uncovered by the decay of overlying beds of limestone.

Tertiary quartzites were observed in the Sergipe basin at the following localities:

1. Sitio da Ribeira, on the Rio Sergipe as one ascends the stream from Aracajú towards Pintos, on the north-west side, opposite Andorinhas quarries. These blocks have evidently been derived from beds at a higher elevation and have been left here by denudation.

2. On the hill-tops west of Maroim, and beyond (from the town) the church Maroim de Cima.

3. Fazenda de Sto. Antonio, three-quarters of a mile west of the church. These quartzites are also on the hill-tops.

4. East of Sto. Antonio, and visible from the church of Maroim de Cima is a hill covered with quartzite.

5. Immediately north-west of Maroim on the hill-top, exfoliating in blocks. Along the Estrada Real also north-west of Maroim, a bed one to two feet thick is exposed. The Santa Cruz church north-west of Maroim is on a hill of ferruginous conglomerate, bare of vegetation.

SURFACE GEOLOGY.

Post-tertiary.—On the hills west of the Cotinguiba at a sitio near Maroim known as Sitio de Belemges, and again along the hills about the Santa Cruz church north-west of Maroim, are types of a formation overlying the tertiary. This formation is spread over the hills and valleys of the Sergipe-Alagôas basin and over the adjacent country in the form of a thin coating of cobblestones, pebbles and sand, sometimes loose and sometimes cemented into a pudding-stone as much as ten feet in thickness, and, when exposed, stained black by manganese. It caps the summits of the tertiary plateaux or their outliers, and it is frequently strewn along down the sides of hills and accumulated in the valleys. It is not confined to the geographic limits of the cretaceous or tertiary, but is found further inland and far beyond the present limits of these formations. It is everywhere more or less irregular in thickness, and nowhere can it be said to be universal or continuous. The writer has seen this material throughout Sergipe and Alagôas, in Parahyba, and as far inland as the headwaters of the Rio Ipanéma in the interior of the province of Pernambuco, where there is no remnant of stratified tertiary beds. Between the lower Rio São Francisco and the frontier of the province of Alagôas, and indeed in many parts of the province of Pernambuco, this water-worn material is found mingled in bogs with the remains of extinct, gigantic mammals.

One of the marked characteristics of this post-tertiary formation is that it is much coarser inland, and grows finer as the coast is approached. The explanation of this water-worn material seems to be that the tertiary period was closed by a depression along the present coast, which carried the beach line far inland, or that it was already there. Then followed a gradual emergence, during which the whole area now covered by this widely distributed water-worn material was passed gradu-

ally through the condition of a beach upon which the then loose, angular, surface rocks of the country were rounded and worn into the boulders, cobbles and pebbles which we now find scattered over this region. While the surf was beating upon and wearing the hard crystalline and metamorphic rocks of the interior it was unable to produce any very marked effect upon the topography of the country, but when, in the course of the land's emergence, the soft, sandy and clayey beds of the tertiary were brought within its reach, the work of land sculpture it was able to do was enormously increased. During the emergence of these tertiary beds they were deeply eroded, and the mud which originally made part of them was washed seaward, and their coarser materials were concentrated upon the slowly receding beach. In some places these accumulations assume unusual proportions, as if they had been brought together by the gradual beating of waves along a beach, or had been reconcentrated by later streams. An example of this kind, outside the Sergipe-Alagôas basin, occurs at the Camassarí diamond washings in the province of Bahia (*v.* Plate V). It would seem that during this period some of the wider valleys excavated in the tertiary were formed. The concentration of coarse material left spread over the surface of the remaining portions of the tertiary, and indeed over the whole country rising from the bottom of the ocean, the thin covering of cobblestones, and pebbles such as we now have. Later, by the oxidation of the iron in these beds they have been changed here and there to a ferruginous conglomerate.

The post-tertiary deposit is very widespread in Brazil, and has been referred by both Agassiz and Hartt to glacial action.

Diamond Washings of Camassarí ; Province of Bahia.

Part IV.

BIBLIOGRAPHY.

Bibliography of the Geology of Sergipe-Alagôas Basin.

Anonymous Articles: A Commissão Geologica do Brazil, published in "O Vulgarisador" newspaper of Rio de Janeiro, Brazil, November 3, 1877.

The same article was reprinted in "O Novo Mundo," an illustrated periodical published in New York, Vol. VIII, January, 1878, pp. 18–19.

The article gives a brief sketch of the region explored and the collections made by the Imperial Survey.

Comstock, T. B.—American Journal of Science, XI, June, 1877, pp. 466-473, contains an abridged report by Prof. Charles F. Hartt upon the work of the Commissão Geologica do Brazil, translated by T. B. Comstock from the report printed in Portuguese. See Hartt, Relatorio Preliminar de Trabalhos da Commissão Geologica na Provincia de Pernambuco.

Derby, Orville A.—O Brazil Geographico e Historico; A Terra e o Homem, por J. E. Wappaeus, Rio de Janeiro, 1884.

This book upon the physical geography, natural history, etc., of Brazil, is the work of several collaborators, the geology (Chap. V, p. 44 *et seq.*) having been written by Mr. Derby. He mentions the provinces in which cretaceous and tertiary formations are found, and gives a small map showing their general distribution, and remarks that the relation between the cretaceous along the coast and that at higher elevations is not known.

Derby, O. A.—Contributions to the Paleontology of Brazil, by Charles A. White.

The descriptive part of this important work, pp. 7–14, is by Mr. Derby, and is the most important paper yet published upon the stratigraphy of the mesozoic and tertiary geology of Brazil. The leading facts known to him regarding all the Brazilian cretaceous localities, except those of São Francisco do Sul, are given. The theory advanced by Mr. Derby, however, to the effect that the Ceará beds "appear to be a distinct series" because they rise to a greater elevation than other known localities, is criticised on pages 408–410 of the present paper.

Derby, O. A.—Contribuições para o Estudo da Geologia do Valle do Rio São Francisco, pelo Dr. O. A. Derby, published in the Archivos do Museu Nacional, Vol. IV, 1879, p. 87 *et seq.*

In connection with the geology of the lower São Francisco, Mr. Derby takes occasion to sketch and discuss the cretaceous and tertiary geology of the entire

Brazilian coast. He announces the important discovery of secondary beds at Atalho and Caissara on the São Francisco, above the falls of Paulo Affonso, and expresses the opinion that they extend to the south along that side of the valley.

These beds are said to resemble those of Bahia, but doubt is expressed regarding their being the same, because the author finds it "difficult to admit the contemporaneous deposition of beds at such different elevations."

GARDNER, GEORGE.—Travels in the Interior of Brazil, principally through the Northern Provinces and the Gold and Diamond Districts during the years 1836–1841, by George Gardner, F.L.S., London, 1846, 113–147. There are but few important notes on the geology of Sergipe-Alagôas. On p. 119, he says the rocks at Penedo dip west, which should read east. On p. 198 *et seq.*, he describes the chalk formation of Ceará. This is substantially a repetition, with less detail, of the article from the Proceedings of the Glasgow Philosophical Society, of April, 1843, referred to below.

HARTT, CH. FRED.—Geology and Physical Geography of Brazil, by Ch. Fred. Hartt, Boston, 1870.

This book contains all sorts of valuable scientific information regarding all parts of Brazil. The observations of the writer, who visited Minas Geraes and the provinces along the coast north of Rio, are supplemented by a study of almost all the best authorities regarding the geography, geology and natural history of the Empire, so that the work represents, better than any other, the state of knowledge of Brazilian geology at the time of its publication. Following Agassiz, he refers the surface geology to the glacial drift, gives excellent descriptions of the tertiary at many localities, refers the sedimentary beds of the Abrolhos, and the fresh-water deposits of the Bahia basin to the cretaceous. He touched at Aracajú, Maroim and Penedo, and from Maroim took away a small collection of fossils, which lead him to refer the rocks of the region to the cretaceous. On pages 555 *et seq.* he gives a resumé of the mesozoic geology of Brazil. The name "Sergipian group" is proposed for the limestones of Maroim, and the "Cotinguiban group" for the cream-colored limestones of Sapucary. The work is illustrated with many carefully executed wood-cuts, among which are numerous valuable geological sections.

HENDERSON, JAMES.—A History of Brazil, by James Henderson, London, 1821.

He mentions the occurrence of flints and limestones in the province of Sergipe.

HYATT, ALPHEUS.—Report on the Cretaceous Fossils from Maroim, Province of Sergipe, Brazil, by Alpheus Hyatt. In Hartt's Geology and Physical Geography of Brazil, p. 385 *et seq.*

Five species of fossils, mostly cephalopods, are described from a collection made at Maroim by Prof. Hartt.

HYATT, PROF. ALPHEUS.—The Jurassic and Cretaceous Ammonites collected in South America by Prof. James Orton, with an Appendix upon the Cretaceous Ammonites of Prof. Hartt's collection, by Alpheus Hyatt. Proceedings of the Boston Society of Natural History, Vol. XVII (May, 1875), pp. 365–372, Boston, 1875.

This paper has a brief note upon *Buchiceras harttii* Hyatt, described by him in Hartt's Geology of Brazil, p. 386, as *Ceratites harttii.*

MOUCHEZ, CAPT. ERNEST.—Les Côtes du Brésil, Descriptions et Instructions Nautiques, par M. Ernest Mouchez, Captain de Vaisseau. Premiére Section. Du Cap San Roque a Bahia, Paris, 1874.

Although this work has nothing directly upon geology, it contains many facts of great value in studying the geology of the northeastern coast, and especially the tertiary of Brazil, which is so intimately connected with the present aspect of the coast in many places. On p. 16 are observations upon the continental shelf; on pp. 20-21, the currents of the coast and tides and reefs are discussed, while the elevations of a great many points along the coast are given. On p. 145, he says that gold and diamonds are found in Itabaiána, and speaks of a great quantity of "*tourbe* combustible" and the probability of coal being found, and adds that "Cette province est également célèbre par les richesses fossiles qu'on y rencontre, principalement sur les bords du São Francisco."

WHITE, CHARLES A.—Contribuições á Paleontologia do Brazil (com o original em inglez), por Charles A. White, M.D. Archivos do Museu Nacional, Vol. VII, Rio de Janeiro, 1887.

An extract from the Archivos was made of this paper and issued with an announcement and "errata," by Dr. White, from Washington, D.C., dated January 2, 1888, under the title, "Contributions to the Paleontology of Brazil; Comprising Descriptions of Cretaceous Invertebrate Fossils, Mainly from the Provinces of Sergipe, Pernambuco, Pará and Bahia."

This work is by far the most important one ever published upon the paleontology of Brazil. The bibliography of the invertebrate mesozoic paleontology of South America is given, followed by a brief but comprehensive sketch of the mesozoic geology of Brazil, by Mr. Derby.

315 species of mesozoic fossils are described, 170 of which are new. These include the lamellibranchs, gasteropods, cephalopods and echinoderms, collected by the Imperial Geological Survey in the provinces of Sergipe, Bahia, Pernambuco and Pará. All are accompanied by excellent plates of 445 figures, drawn by McConnell and lithographed by Sinclair, of Philadelphia. In a discussion of the geologic age of the Sergipe beds, Dr. White concludes that, in spite of the jurassic facies of several of the fossil forms, the burden of testimony favors the reference of these beds to the cretaceous.

Bibliography of the Cretaceous and Tertiary Geology of Brazil bearing upon that of the Sergipe-Alagôas Basin.

The mesozoic and tertiary geology of Brazil is so intimately connected with that of the other portions of South America that the bibliography of one portion must of necessity include much of that of the other. For this reason some titles are given

here which do not relate directly to the mesozoic or tertiary geology of Brazil. There are besides many valuable works upon the geology of the River Plate basin, the west coast and north-eastern South America, by such writers as Darwin, D'Orbigny, Burmeister, Castelnau, Humboldt and Spix and Martius, to which one naturally turns for trustworthy information in studying the geology of the continent. With the exception of the publications of Spix and Martius, which the writer has been unable to consult carefully, the most pertinent of these works are referred to, the others are omitted. The titles given under the preceding head must, of course, be added to this list.

Agassiz, Louis.—Edinburgh New Philosophical Journal for January, 1841. Description of the Fossil Fishes Collected by George Gardner in the Province of Ceará, by Louis Agassiz.

Prof. Agassiz referred the beds from which they were taken to the cretaceous.

Agassiz, Louis.—The Atlantic Monthly (Boston, Mass.) for July and August, 1866. Physical History of the Valley of the Amazon, by Louis Agassiz.

In this article the author expresses the opinion that Ceará and the region north of that province belong geologically to the Amazon Valley region, describes briefly its tertiary deposits, and refers them "to the ice period in its earlier or later phases."

To explain its aqueous origin, he postulates a gigantic terminal moraine closing the valley at its eastern end, behind which these beds are supposed to have been deposited in cold fresh water.

Agassiz, Prof. Louis.—Geological Sketches, by Louis Agassiz. Boston, 1886, Vol. II, p. 153 *et seq.*

The chapter on the "Physical History of the Valley of the Amazons" is the same as that published under this title in the *Atlantic Monthly* for July and August, 1866.

Agassiz, Louis and Major João Martins da Silva Coutinho.—Sur la Géologie de l'Amazone, par MM. Agassiz et Coutinho, Paris, E. Biot, 1867, 8. Extrait du Bulletin de la Societé Géographique de France.

Substantially the same views are here given as are published in the Atlantic Monthly article referred to above.

Agassiz, Prof., and Mrs. Louis.—A Journey in Brazil, by Prof. and Mrs. Louis Agassiz, Boston, 1868.

On pp. 146–7, are remarks by Prof. Agassiz upon the so-called glacial drift at Bahia, Pernambuco, Maceio, Parahyba and Pará. He refers to the fossils found at Parahyba do Norte, and he discusses the so-called drift phenomena of the Amazon Valley region. The clays and sands referred to here as glacial drift are tertiary, and the water-worn material found at the places referred to is the "wash," or concentrated coarse material left scattered over the region, as the land rose from beneath the ocean at the close of the tertiary.

AGASSIZ, PROF. LOUIS.—Comtes Rendus de l'Acadamie Francais, Vol. XVIII, p. 1007.

Letter from Louis Agassiz to Élie de Beaumont describing the fossil fishes from Ceará. Seven species are mentioned by him, and he affirms his belief in the cretaceous age of the Ceará rocks.

ALLEN, J. A.—Notes on the Geological Character of the Country between Chique-Chique, on the Rio de São Francisco and Bahia, Brazil, by J. A. Allen. In Hartt's Geology and Physical Geography of Brazil, pp. 309–318.

A brief but very important contribution to the geology of Eastern Brazil. The author does not attempt to give the horizons of the geological formations found upon his trip, but his descriptions enable one acquainted with the geology of the country to assign them to their various equivalents along the coast.

ALLPORT, S.—On the Discovery of Some Fossil Remains near Bahia in South America. Quar. Jour. Geol. Soc., London, Vol. XVI, Pt. III, pp. 263–268.

The article is illustrated, and, besides a brief description of the eastern portion of the Bahia basin about Montserrate and Plataforma, is accompanied by notes on the fossils by John Morris and Prof. T. Rupert Jones. The vertebrate remains described by Mr. Allport are figured in four plates.

ANONYMOUS.—Annual of Scientific Discovery for 1866–7, pp. 270–3.

Agassiz's Lowell Institute lectures are quoted as to the glacial origin of the tertiary of the Amazon.

ANONYMOUS.—Annual of Scientific Discovery for 1871, pp. 246–7.

These notes appear to have been taken from Prof. Hartt's writings. It is stated that the cretaceous beds probably underlie the tertiary of the whole Amazon Valley.

BATES, HENRY WALTER.—The Naturalist on the Amazons, by Henry Walter Bates. 4th ed., London, 1875.

A few notes are given in this work concerning the table-topped hills of Almeyrim and the serras north of that point, and upon the parti-colored cliffs about Obidos.

BROWN, C. BARRINGTON.—Tertiary Deposit of the Solimões and Javary Rivers in Brazil, by C. Barrington Brown, with an Appendix by R. Etheridge. Quarterly Journal of the Geological Society, February, 1879.

Reference is made to the old loess-like river deposits, and several sections of the tertiary are given. Noting that the tertiary had already been traced from Loreto, Peru, to Tabatinga, the author says that he has not seen this terrane further east than São Paulo, 150 miles below Tabatinga and 1350 miles from the mouth of the Amazon. It is suggested that the tertiary beds have been disturbed. They are said to occupy here an area of 300 miles in length by 50 in breadth, and contain both fresh and brackish water shells.

BROWN, C. BARRINGTON.—On the Ancient River-deposit of the Amazony, by C. Barrington Brown. Quart. Jour. Geol. Soc., Vol. XXXV, 1879, p. 763 *et seq.*, with illustrations.

This paper treats principally of quaternary and recent deposits, but some references are made to the tertiary, while the sections given indicate its relations to the later formations.

BURMEISTER, H.—Description Physique de la Republique Argentine d'Apres des Observations personelles et étrangers, par le Dr. H. Burmeister, Paris, 1876, 3 vols.

The third volume is dated Buenos Ayres, 1879. This work is a translation from the German. The second volume is upon the geology of the Republic, and the third upon the living and extinct vertebrates. It contains no references to the mesozoic geology of Brazil, but it is useful in connection with its study.

CALDCLEUGH, ALEXANDER.—Travels in South America, during the years 1819–21, etc., by Alexander Caldcleugh, 2 vols., London, 1825.

In Vol. I, p. 48, he refers to the discovery of vertebrate remains, apparently quaternary, near Rio das Contas in the province of Bahia.

CAPANEMA, GUILHERME S. DE.—Trabalhos da Commissão Scientifica de Exploração, Part I, Rio de Janeiro, 1862. Secção Geologica, pp. 120–143, by Guilherme S. de Capanema.

This commission was made up exclusively of Brazilians, and extensive explorations were undertaken. Dr. Capanema was chief of the geologic section. He visited Nazareth and the island of Itaparica in Bahia, Parahyba and Ceará. He speaks of the cretaceous rocks at Parahyba, hitherto unknown, and says that the cliffs at Crato, said by Gardner to be chalk, are silicate of alumina.

CHANDLESS, W.—Notes on the River Aquiry, the Principal Affluent of the River Purús, by W. Chandless. Jour. Roy. Geog. Soc., Vol. XXXVI, 1866, p. 119 *et seq.*

The geology of the region treated of is only incidentally referred to in this article. The localities are mentioned from which were taken silicified woods, the remains of Mosasaurus, and of extinct turtles.

COMSTOCK, T. B.—American Journal of Science, 1876, pp. 464–6. Note by T. B. Comstock upon the Work of the Commissão Geologica do Brazil.

This note refers principally to the work done by the Brazilian Survey in the Amazon Valley.

COPE, E. D.—A Contribution to the Vertebrate Paleontology of Brazil, by E. D. Cope. Proceedings of the American Philosophical Society, Vol. I, No. 121, January, 1886, pp. 1–21.

Descriptions of mesozoic fossils from Bahia, Sergipe and Pernambuco. In this paper Prof. Cope attempts to correlate the Brazilian mesozoic beds with those of the United States. The occurrence of the teeth of one species of fishes (*Apocopodon*

sericeus Cope) induces him to believe the Maria Farinha beds of Pernambuco one probable equivalents of the Fox Hills of the United States, or to the Mæstrichtian cretaceous age. Another species from Sapucary leads him to say (p. 7) that these rocks "probably belong to the cretaceous." One species from the north-eastern part of the province of Bahia leads him to refer those rocks to the pliocene-pampæan.

COUTINHO, JOÃO MARTINS DA SILVA.—L'Embouchure de L'Amazone, par Don João Martins da Silva Coutinho. Bulletin de la Societé de Géographie, Paris, Octobre, 1867.

The statement is made that the same geology (the tertiary) prevails from the mouth of the Huallagua in Peru to Marajó and to Piauhy.

DARWIN, CHARLES.—Geological Observations on the Volcanic Islands and Parts of South America Visited During the Voyage of H. M. S. "Beagle," by Charles Darwin, M.A., F.R.S., etc., London, second edition, 1876.

Though there is but little in this book which deals directly with the mesozoic and tertiary geology of Brazil, Chapter VIII, upon the elevations of the eastern coast of South America; Chapter XI, on the formation of the Pampas; Chapter XII, upon the older tertiary of Patagonia and Chile, are rich in suggestions which must be kept constantly before the mind in studying the cretaceous and tertiary of Brazil. Appendices to the second part of the volume contain descriptions of secondary and tertiary fossils from South America.

DERBY, O. A.—A Bacia Cretacea do Bahia de Todos os Santos, por Orville A. Derby, M.S. Archivos do Museu Nacional, Vol. III, third and fourth Trimesters, Rio de Janeiro, 1878, pp. 135–158.

In this memoir Mr. Derby brings together all the observations made, up to the time of publication, upon the fresh water cretaceous basin of Bahia, and the accompanying tertiary and crystalline beds. Inasmuch as Mr. Derby has done more work upon this particular region than anyone else, his paper is the most comprehensive yet published. Its value has now been greatly increased by the publication of Dr. White's Invertebrate Paleontology of that basin. The article is in Portuguese, and has never been published in any other language.

DERBY, O. A.—Revista de Engenharia (Rio de Janeiro), Vol. III (1881), Nos. 6, 8, 9, 11, 12. Reconhecimento Geologica do Valle do São Francisco, por Orville A. Derby, M.S.

The article published in the Archivos do Museu Nacional, Vol. IV, 1879, p. 87 *et seq.*, has all the geological facts more fully discussed.

DERBY, O. A.—A Contribution to the Geology of the Lower Amazonas, by Orville A. Derby, M.S. Proceedings of the American Philosophical Society, Vol. XVIII, 1879, pp. 155–178.

The known cretaceous localities of the Amazon region are mentioned and briefly described on pp. 174–5; the tertiary on pp. 176–7. A Portuguese version of this paper is also published in the Archivos do Museu Nacional, Vol. II, 1877, pp. 77–104,

under the title: Contribuições para a Geologia da Região do Baixo Amazonas, pelo Prof. Orville A. Derby, M.S.

D'Orbigny, Alcide.—Voyage dans les deux Amériques, publié sous la direction de M. Alcide D'Orbigny, Paris, 1859.

Several references to Brazilian geology as made for pp. 120–185, but as this book was intended for a popular work of travels, it contains nothing of importance upon geology. On p. 185, it is remarked, however, that "le calcaire s'y trouve en boucoup d'endroits."

D'Orbigny, Alcide.—Voyage dans l'Amérique Méridionale, Géologie et Cartes, Paris, 1842.

The only maps referring to Brazilian cretaceous and tertiary geology are included in Plate X, Figs. 1, 4 and 5. The text in which these general charts are explained relates mainly to the geology of the River Plate basin, Patagonia and the West Coast. Though this publication represents a great deal of valuable geological details, it contains a vast amount of speculation which, as far as Brazil is concerned, is of doubtful value. There is nothing directly upon the Brazilian cretaceous and tertiary, but the latter portion of the work, pp. 209 *et seq.*, "considérations générals sur la Géologie de l'Amérique Méridionale," discusses the dynamic movements and building up of the continent. Of the cretaceous terranes, he says (p. 238): "Qu'ils sont tout à fait inconnus aux régions orientales et centrales de l'Amérique Méridionale." The mesozoic and tertiary geology of Brazil can best be understoood by a study of that of the central and western parts of the continent, which he treats at some length, in the Géologie and Paléontologie of his voyage. On p. 237, he discusses the existence of the jurassic in South America.

D'Orbigny, Alcide.—Comptes Rendus de l'Académie des Sciences, 1842, Vol. XV, p. 771. Considérations générales et coup d'œil d'ensemble sur les grands faits géologiques dans l'Amérique Méridionale a été le théatre, par Alcide D'Orbigny.

The conclusions of this brief paper are highly imaginary.

Durand, l'Abbé.—Considérations générales sur l'Amazone, par l'Abbé Durand. Bul. de la Soc. de Géographie, Paris, Novembre, 1871.

It is stated that the tertiary seems to be entirely wanting in the Amazon basin; that the bottom of the basin is cretaceous, overlain by from seven to forty metres of clays, above which is a formation of sands, clays and gravels, which are referred to the "trias ou terrain de vieux grès rouge." A very wide distribution is attributed to this formation.

Etheridge, R.—Notes on the Mollusca collected by C. Barrington Brown from the Tertiary Deposits of Solimões and Javary Rivers, Brazil, by R. Etheridge. Quart. Jour. Geol. Soc., XXXV, 1879, p. 82.

An appendix to Mr. Brown's paper, *q. v.*, consisting of specific descriptions of tertiary fossils.

GARDNER, GEORGE.—Geological Notes made during a Journey from the Coast into the Interior of the Province of Ceará, in the North of Brazil, embracing an Account of a Deposit of Fossil Fishes, by George Gardner, Esq. Edinburgh New Philosophical Journal, April, 1841, p. 75 *et seq.*

HARTT, CH. FRED.—The American Naturalist, Vol. II, March, 1868, No. 1. A Naturalist in Brazil, by Ch. Fred. Hartt.

Brief description and illustrations of the geology of the Abrolhos. The same is given more fully in the author's larger work upon the Geology and Physical Geography of Brazil.

HARTT, CH. FRED.—On the Growth of the South American Continent, by Ch. Fred. Hartt. The Cornell Era (Ithaca, N. Y.), December 12, 1868.

This paper deals with the dynamic movements of the continent, and gives the general order and distribution of the various formations.

HARTT, PROF. CH. F.—Amazonian Drift, by Prof. Ch. F. Hartt. American Journal of Science, April, 1871, pp. 294–296.

The writer expresses the opinion that the horizontally bedded sandstones and clays of the Amazon region referred by Agassiz to glacial drift are tertiary.

HARTT, PROF. CHARLES FRED.—On the Tertiary Basin of the Maranon, by Charles Fred Hartt. American Journal of Science, Vol. IV, July, 1872, pp. 53–58.

This article deals with the tertiary beds of the Upper Amazon region.

HARTT, CHAS. FRED.—Recent Explorations in the Valley of the Amonzonas, by Chas. Fred. Hartt. Journal of the American Geographical Society, New York, Vol. III, 1872, pp. 231–252.

The then known extension of the cretaceous in the Amazon Valley is mentioned, and there are a few notes upon the tertiary. The author reiterates his belief in the tertiary age of the Serras of Parú.

HARTT, CHAS. FRED.—Preliminary Report of the Morgan Expedition, 1870–71. Report of a Reconnoissance of the Lower Tapajos, by Chas. Fred. Hartt. Bulletin of the Cornell University (Science), Vol. I, No. 1, Ithaca, N. Y., 1874, pp. 1–37.

This paper sketches the work done by the Morgan Expedition, and contains a few unimportant references to the tertiary beds in the Lower Amazon region.

HARTT, CH. FRED.—Contributions to the Geology and Physical Geography of the Lower Amazonas, by Chas. Fred. Hartt. Bulletin of the Buffalo Society of Natural Science, January, 1875, pp. 201–235.

Contains good descriptions and sketches of the tertiary geology of the Lower Amazonas.

HARTT, CHARLES FRED.—Relatorio Preliminar dos Trabalhos da Commissão Geologica na Provincia de Pernambuco, por Ch. Fred. Hartt, Chefe da mesma Commissão, Rio de Janeiro, 1875.

This paper contains a few brief notes upon the cretaceous geology of the province of Pernambuco.

HUMBOLDT, ALEXANDER VON.—Personal Narrative of Travels to the Equinoctial Regions of the New Continent during the years 1799-1804, by Alexander Von Humboldt and Aimé Bonpland (English translation from the original French), third edition, London, 1822.

Humboldt and Bonpland did not enter Brazil, and their observations upon the geology of adjacent territory are referred to as valuable supplementary material in the study of the geology of Brazil.

JONES, T. RUPERT.—Note on the Fossils Entomostraca from Monserrate (Bahia), by T. Rupert Jones. Proc. Geol. Soc., Vol. XVI, p. 266.

Descriptions of five species of Cypridæ are given, and Prof. Jones says that they appear to be allied to the recent and tertiary species. This note is a part of an article by S. Allport, on the cretaceous fossils of Bahia. See under Allport.

LIAIS, EMMANUEL.—Climats, Géologie, Faune et Géographie Botanique du Brésil, par Emmanuel Liais. Paris, 1872.

The author of this book traveled extensively in Brazil, and his remarks upon the geology of that country represent much personal observation. For many of his statements, however, he gives no authority. Here and there discussions of the geology of the entire South American continent and correlations of terranes of widely separated regions are attempted. Chapter V is devoted to the discussion of secondary geology, and Chapter VI to that of the tertiary and quaternary. On p. 186, he says that fossils collected by M. Meyen from a locality on the west coast of South America and studied by Von Buch contained both cretaceous and jurassic species. Much doubt as to the value of the book is caused by a considerable number of serious errors. What appear to be facts of great value are so interwoven with figments of the imagination that, to those best acquainted with the geology of Brazil, it does not merit the confidence one would like to give it.

MARSH, PROF. O. C.—Notice of Some New Reptilian Remains from the Cretaceous of Brazil, by Prof. O. C. Marsh. American Journal of Science, May, 1869, pp. 390–392.

These fossils are from the Bahia basin, and include Crocodilus, Thoracosaurus, Megalosaurus. Lepitodus scales are reported.

MORRIS, JOHN.—Note on the Molluscan Remain from Monserrate (Bahia). Quart. Jour. Geol. Soc., London, Vol. XVI, p. 266.

This note, containing the description of one species of *Melania*, is part of an article by Allport. See under Allport.

PEREIRA, FELIPPE FRANCISCO.—Roteiro da Costa do Norte do Brazil desde Maceio ate Pará, por Felippe Francisco Pereira, Pernambuco, 1878.

This work contains geographical notes of value in this connection. The hills described and figured along the immediate coast between Maceio and Pará are nearly all tertiary, except that of Cape Santo Agostinho, which is of igneous origin.

PISSIS, M. A.—Mémoire sur la position Géologique des Terraine de la Partie Australe du Brésil, et sur les Soulèvements qui, à Diverses Époques, ont Changé le Relief de cette Contrée, par M. A. Pissis (présenté a l'Académie das Sciences le 27 Juin, 1842).

This paper relates mostly to the geology of the crystalline rocks of Rio de Janeiro, São Paulo and Minas Geraes. On pp. 397–8, he speaks of the tertiary along the coast between Rio and Bahia, and on pp. 398–9, on the Bahia basin.

In the plates accompanying this memoir, he gives a section at Monserrate, Bahia, while his geological map represents the Bahia fresh water cretaceous basin as tertiary, with a fresh water division covered by marine beds. On this point, see Mr. Rathbun's paper upon the geology of Ithaparica. On p. 403 *et seq.*, he discusses the "grands movements du sol" and gives a list of dips. Of the tertiary, he says that the marine tertiary of the coast is represented by lacustrine beds in the interior.

POMPEO DE SOUZA BRAZIL, THOMAZ.—Ensaio Estatistica da Provincia do Ceará, por Thomaz Pompeo de Souza Brazil, 1863.

This work mentions, besides a list of minerals found in the province, the occurrence of cretaceous and quaternary fossils at a number of places (pp. 144–160).

PORTO SEGURO, VISCONDE DE.—Historia Genal do Brazil antes de sua Separação e Independencia de Portugal, pelo Visconde Porto Seguro, Rio de Janeiro, without date. Two vols.

In Vol. I, p. 353, it is stated that the location of the city of Parahyba was fixed by the existence there of a calcareous sandstone, which is in places a true limestone and in others marble.

RATHBUN, RICHARD.—Sketch of the Life and Scientific Work of Prof. Charles Fred. Hartt, by Richard Rathbun. Proceedings of the Boston Society of Natural History, Vol. XIX, pp. 238–364, 1878.

A list is given of the localities at which cretaceous, tertiary and post-tertiary rocks occur. A brief sketch is given of the work accomplished by the Commissão Geologica do Brazil, under Prof. Hartt, and of the geological structure of the various regions explored.

RATHBUN, RICHARD.—Observações sobre a Geologia da Ilha de Itaparica na Bahia de Todos os Santos, por Mr. Richard Rathbun. Archivos do Museu Nacional.

This paper deals with the geology of the island mentioned, but comparisons are made with the geology of the mainland. Most of the paper is occupied with a description of the reefs.

RATHBUN, RICHARD.—Preliminary Report on the Cretaceous Lamellibranchs Collected in the Vicinity of Pernambuco, Brazil, by Richard Rathbun. Proceedings of the Boston Society of Natural History, XVII, 1874, pp. 241–256.

This paper describes twelve new species of Lamellibranchs of the collection made in 1870 by the Morgan expedition, under Prof. Hartt. The prefatory portion of the

paper contains brief notes upon the stratigraphic geology, which are credited to the notes of Mr. Derby.

READE, T. MELLARD.—Denudation of the two Americas, by T. Mellard Reade, C.E., F.G.S. American Journal of Science, Vol. XXIX, No. 172, April, 1885, pp. 290–300. Substance of Presidential Address to the Liverpool Geological Society, Session 1884–5.

A part of this paper is devoted to the rate of denudation of the Amazon basin, and references are made to the nature and distribution of the rocks.

SAMPAIO, THEODORO FERNANDES.—*Revista de Engenharia*, Vol. VI (1884), pp. 52–54. Informações a respeito dos caracteres geologicos do territorio comprehendido entre a cidade de Alagoinhas e a do Joazeiro, por Theodoro Fernandes Sampaio.

Short but valuable notes upon the geology of the region along the railway line from Alagoinhas to the Rio São Francisco. The second chapter treats of the tertiary region, which is said to extend from Alagoinhas to Agua Fria, a distance of fifty-six kilometres.

SMITH, HERBERT H.—Do Rio de Janeiro a Cuyaba. Notas de um Naturalista, por Herbert H. Smith, Rio de Janeiro, 1887.

Reference is made, pp. 10–11, to the evidences of the elevation of the eastern coast of Brazil (Rio) during the quaternary.

WILLIAMSON, E.—On the Geology of the Parahyba and Pernambuco Gold Regions, by E. Williamson. Transaction of the Manchester Geological Society, Part VII, Vol. VI.

This paper is devoted to the occurrence of gold and to the geology of the crystalline and metamorphic rocks of the region. A valuable note is given on the limestones and the tertiary beds which cover them.

WOODWARD, HENRY.—The Tertiary Shells of the Amazon Valley, by Henry Woodward. From the Annals and Magazine of Natural History, for January and February, 1871.

—Challenger Reports. Narrative, Vol. I, Part I, p. 215–217.

The soundings and dredging along the Brazilian coast indicate that the ocean's bottom is here remarkable for the absence of animal remains and glauconite, and that it is covered by fine red mud (pp. 215–217).

ARTICLE VIII.

DESCRIPTIONS OF NEW SPECIES OF FOSSILS

FROM THE

CLINTON, LOWER HELDERBERG, CHEMUNG, AND WAVERLY GROUPS, FOUND IN THE COLLECTIONS OF THE GEOLOGICAL SURVEY OF PENNSYLVANIA.

BY GEORGE B. SIMPSON.

Read before the American Philosophical Society, December 21, 1888.

In determining the species in the collections of Messrs. Hall, Sherwood, Fellows, and others, I found a number of species which I could not reconcile with any known to me, or with any published in the books to which I had access.

Prof. James Hall, of Albany, N. Y., was kind enough to review these specimens with me, and decided that many of them were new. Of these new species nineteen are described in this paper. The eleven other species I had no opportunity to submit to him, but I have no doubt that they also are species that have not hitherto been described.

GEORGE B. SIMPSON.

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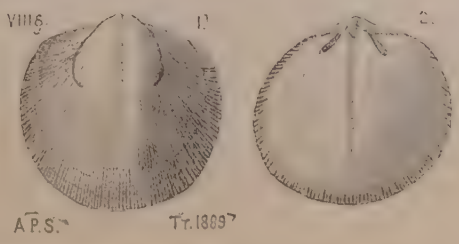
ORTHIS PENNSYLVANICA Simpson, n. sp., Fig. 1.

Shell essentially circular, in nearly all the specimens observed, the height and width being equal; hinge line short, length equal to half the width of the shell; cardinal extremities rounded; lateral and basal margins regularly rounded, except in the middle basal margin of the ventral valve, where there is a slight constriction.



Dorsal valve somewhat gibbous, greatest convexity a little above the middle; rapidly curving to the cardinal and lateral margins; a little more gradually to the basal margins. Along the middle of the valve is a flattened or slightly depressed area, narrow at the beak, gradually growing wider, and comparatively broad at the base.

Ventral valve. A perfect specimen has not been observed, but gutta-percha casts have been taken from impressions of fragments in the rock which probably belonged to this species. The valve is flattened, or of much less convexity than the dorsal valve, with a slight elevation along the middle, corresponding to the depression of the opposite valve.

Surface marked by prominent, subangular, radiating striæ, increasing by bifurcation, of uniform size at the margins, where there are twelve in the space of 5 mm.; a short distance below the beak there are twenty in the same space. The radii are crossed by fine indistinct concentric striæ, which on many specimens are obsolete; also, at irregular intervals, by lines or varices of growth.

On the cast of the dorsal valve the distance from the beak to the lower margin of the muscular impression is about one-half the length of the valve. Impression ovate in outline; width equal to or very slightly less than the length, with a deep depression along the middle. On the ventral valve the impression is ovate, bilobed. The margins are distinctly lobed in four divisions. The greater portion of the specimens observed have a diameter of from 20 to 25 mm.

This species may be distinguished from *Orthis impressa*, of this formation, by its smaller size and its more circular outline; from *Orthis tioga*, by its more circular outline, less conspicuous sinus and elevation, and ovate muscular impression.

Formation and localities. Chemung group, Sullivan township, Tioga county; P. and E. Railroad, between Ludlow and Wetmore, and Kinzua creek near west line of McKean county; and at various other localities in Pennsylvania.

ORTHIS SUBCIRCULA Simpson, n. sp., Fig. 2.

Shell broadly oval, nearly circular; height usually about three-fourths the width; greatest width just below the middle; cardinal line short, length less than half the

width of the shell; extremities curving outward, the lateral margins abruptly rounded, and the basal margins broadly rounded; on the ventral valve slightly constricted at the middle. Dorsal valve flattened, greatest convexity a little below the beak, gently sloping to the front and lower lateral margins, more abruptly curving to the cardinal extremities; at the middle of the base a shallow depression, which continues about one-half of the distance to the beak. Ventral valve more convex, greatest convexity about one-third the length from the beak; beak incurved and projecting beyond the area line.

Surface marked by conspicuous radiating striæ, which are sometimes of uniform size, but usually near the base there are very fine alternating striæ. The large striæ are marked at infrequent intervals by elongate pits or openings. The radiating striæ are crossed by fine, indistinct concentric striæ, and at greater intervals by distinct lines or varices of growth.

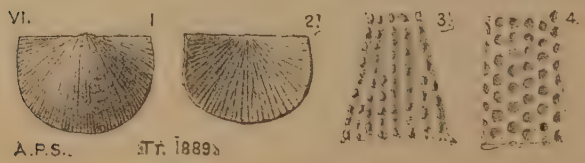
On the casts of the interior of the ventral valve the muscular impression is ovate in outline, the length equal to more than two-thirds that of the shell; width two-thirds the length; bilobed by the callosity of the adductor muscle. The sides are somewhat distinctly lobed in three divisions.

This species most closely resembles *Orthis circulus* of this formation, but the valves are inequal, the outline less circular, the greatest width being below the base, and is constricted at the base. The muscular impression is larger.

Formation and locality. Clinton group, above fossil ore, from McKee's ore bank, seven miles north-west of Lewistown, Mifflin county; also, ore mine north of Blacklog creek, Orbisonia, Huntingdon county, Pennsylvania.

CHONETES PUNCTATA Simpson, n. sp., Fig. 3.

Shell semicircular, plano-convex or concavo-convex; greatest width at about the middle of the shell; height from two-thirds to three-fourths the width; length of hinge line usually less than the width of the shell, but sometimes equal to it and occasionally greater. The cardinal extremities are rectangular, or sometimes produced in slight acute extensions, rarely rounded; lateral and dorsal margins regularly rounded.



Ventral valve, varying from moderately convex to gibbous; greatest convexity at the middle, gently curving to the beak, more rapidly to the latero-basal margins,

and abruptly towards the hinge line. At the cardinal extremities there is a flattened area 2 mm. or more in width, gradually growing narrower to the beak.

Dorsal valve, variably concave, sometimes nearly flat, at other times following the contour of the ventral valve; always with a flat area corresponding to that of the opposite valve.

Surface marked by rounded or subangular striæ, which increase by bifurcation; at the base there are four in the space of 1 mm. The radiating striæ are crossed by extremely fine concentric striæ, about twelve in the space of 1 mm., and at irregular intervals by more distinct lines of growth.

On the hinge line are evidences of eight spines, four on each side of the beak, short, slightly oblique.

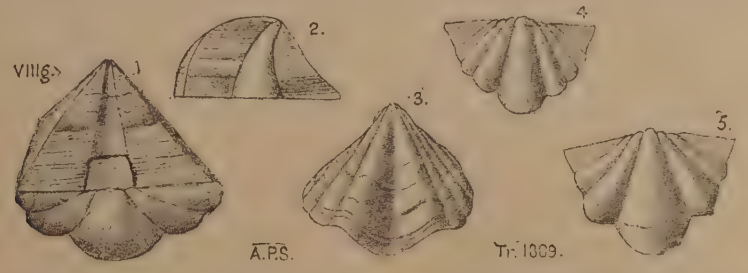
The interior of the ventral valve shows a narrow median ridge, with narrow oval occulsor muscular impressions. Corresponding to the radiating striæ of the exterior are rows of small conical nodes, the bases of which are nearly in contact. They continue nearly half way to the beak.

The impression of the interior of the ventral valve has numerous punctæ or holes, caused by the mucronate nodes of the interior; it presents a peculiar clathrate appearance, which is sufficient to distinguish it from any other species.

Formation and locality. Lower Helderberg group, Mansing's quarry, near Hazardville, Carbon county, Pennsylvania.

CYRTINA TRIPLICATA Simpson, n. sp., Fig. 4.

Shell more or less triangular, subpyramidal; hinge line equal to the greatest width of the shell; proportional length and width somewhat variable; length of the



dorsal valve from one-half to two-thirds the width; length of ventral valve about equal to the width; height of the area greater than the length of the dorsal valve.

Ventral valve quadrilateral, subpyramidal; most prominent at the beak, which is variable in elevation, straight, not arching over the area, usually attenuate; lateral margins regularly rounded. Mesial sinus narrow at the beak, rapidly widening as it extends forward, and becoming deep; where it reaches the margin the shell is pro-

duced in a conspicuous sublinguiform extension. Sides of the sinus flat, abruptly sloping, making the bottom angular. Area large, triangular, varying in height; sometimes nearly equal to the width of the shell, at other times not more than half the width; slightly oblique; striated in both directions; the longitudinal striæ distinct; the vertical striæ much fainter and frequently obsolete; fissure moderately narrow and closed by a convex pseudo-deltidium.

There are three or four plications on each side of the sinus, the two bounding the sinus being much more prominent than the others.

Dorsal valve semicircular or subtrigonal in outline; length from one-half to two-thirds the width. Mesial fold broad, prominent, extremely elevated in front, bounded by broader furrows than those between the plications. There are two plications on each side of the mesial fold, the two plications adjacent to the fold being much more prominent than the others; on some of the specimens nearly as prominent as the fold itself, the other two plications being obscure.

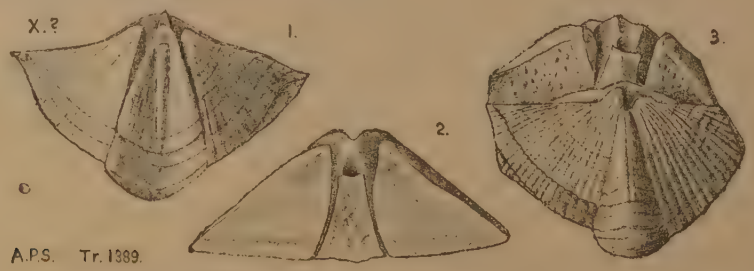
The surface of both valves is ornamented by very fine and delicate concentric striæ, which are obsolete on all but the perfectly preserved specimens. There are also more conspicuous lines of growth which are most prominent on the anterior portions of the shell.

This species most closely resembles *Cyrtina hamiltonensis*, but may be distinguished by the two prominent plications adjacent to the medial fold; this feature will serve to distinguish it from other species of the genus at present known.

Formation and locality. Chemung group, three miles north-west of Warren, in Warren county, Pennsylvania.

SYRINGOTHYRIS ANGULATA Simpson, n. sp., Fig. 5.

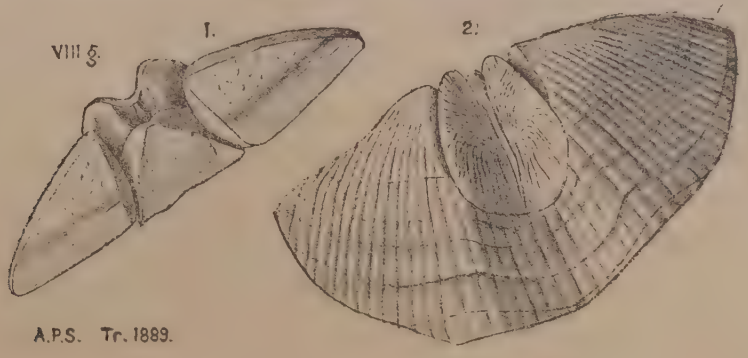
This species closely resembles *S. randalli;* but the specimens are usually of smaller size; the mesial sinus and fold proportionately narrower; the cardinal extremities angular and frequently attenuate.



Formation and locality. Waverly group, near Warren, Warren county, Pennsylvania.

SYRINGOTHYRIS RANDALLI Simpson, n. sp., Fig. 6.

Shell transversely semi-elliptical or semi-circular; ventricose, becoming gibbous with age; length usually about one-half the width, but sometimes three-fourths;



hinge line straight, length equal to the greatest width of the shell. Cardinal angles more or less rounded, not attenuate.

Ventral valve with a high vertical or slightly sloping cardinal area, from the apex of which the sides of the shell curve outward to the antero-basal margins.

A median sinus begins at the beak, rapidly widening as it extends forward, and becoming deep, with abruptly sloping sides; where it reaches the margin the shell is produced in a conspicuous linguiform extension.

The deltidial aperture is covered for about one-half its length from the beak, by an arched transverse callosity or pseudo-deltidium. The edges of this callosity unite with the strong dental lamellæ, which divide the rostral portion of the shell into three chambers; and from the inner posterior surface of the callosity extends the syringothyral tube, which is unusually broad near its posterior extremity, but tapers rapidly to an open termination, sloping into the internal cavity. This tube is split for its entire length along its outer surface, and appears to have been thickened and filled in its posterior portion with the increasing age of the animal.

Dorsal valve convex, greatest convexity at about one-third the length of the shell from the beak; convex to the cardinal line, becoming somewhat flattened at the cardinal extremities; gradually curving to the lateral and basal margins. Mesial fold narrow at the beak, rapidly widening and becoming prominent below; produced at the margin corresponding to the linguiform extension of the ventral valve.

Surface of the valve ornamented by from forty to sixty costæ, which occur both on the sides and the sinus. Radiating striæ crossed by concentric striæ, which, in the specimens observed, are most conspicuous on the mesial fold and sinus. There are also lines of growth, which are usually the strongest on the anterior portion of

the shell. Horizontal lines of growth, without vertical cross lines, are conspicuously developed on the cardinal area.

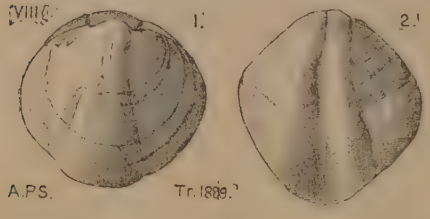
On the ventral valve the muscular scars are strongly developed, and extend over nearly two-thirds the length of the shell; ovate in outline, the width being equal to three-fourths of the length; the area being largely occupied by the cardinals, between which lie the narrow linear adductors. The casts of the dorsal valve show the marks of the deeply striated cardinal process and elongate tooth-sockets. In casts of the ventral valve the whole upper portion and the area are marked by numerous irregularly disposed prominent pustules.

From the external characters alone it would be impossible to separate this species from *Spirifera disjuncta*, but the internal differences are generic.

Formation and locality. Chemung group, near Warren, Warren county; and at Union City, Erie county, Pennsylvania.

MERISTELLA INCERTA Simpson, n. sp., Fig. 7.

Shell subrhomboidal, greatest width at or a little below the middle; length of the ventral valve equal to the width; of the dorsal valve, slightly less. Valves convex, the ventral valve being the most gibbous. Antero-basal margins gently curving outward, at the middle abruptly rounding and the front produced in a broad extension.



Ventral valve the more convex; greatest convexity a little above the middle, abruptly curving to the cardinal margins, and more gradually to the front. A comparatively deep, broad sinus extends from the beak to the base, forming one of the most conspicuous features of the species. Umbo prominent. The beak is broken away on the specimens observed, but enough remains to show that it was rounded, closely incurved, nearly at right angles to the plane of the axis.

Dorsal valve less convex than the opposite, greatest convexity above the middle, regularly curving to the antero-basal margins, elevated towards the base into a mesial fold, which is much less conspicuous than the corresponding depression of the ventral valve; beak small, incurved, lying below that of the opposite valve.

The general aspect of the surface is that of a smooth shell with a few strong lines or varices of growth. There are indications of radiating striæ, and it is possible that specimens in a better condition of preservation would show both radiating and concentric striæ.

The form of this species is very similar to that of *Meristella bella*, of the Lower Helderberg group, but that species has a depression on both the ventral and dorsal valves, while this species has a fold on the dorsal valve. The subrhomboidal form distinguishes it from any species of the Upper Helderberg groups.

Formation and locality. Chemung group, near Warren, Warren county, Pennsylvania.

RHYNCHONELLA (STENOCHISMA) LÆVIS Simpson, n. sp., Fig. 8.

Shell ovate or subtrigonal; valves subequally convex in young shells; in older shells the dorsal valve usually the most gibbous. The width is slightly less than the height; greatest width about two-thirds the length from the beak; margins from the apex to this point slightly curved outward, nearly straight, then somewhat abruptly rounding, and at the base produced in a slight extension.

Ventral valve depressed convex, slightly gibbous at about one-third the length from the apex, curving abruptly to the cardinal and antero-basal margins, more gradually to the lower lateral margins, becoming depressed in a shallow sinus, which commences at about one-third to one-half the length from the beak; beak slightly incurved, strongly projecting beyond the beak of the opposite valve.

Dorsal valve convex, greatest convexity at or a little below the middle, gradually curving to the apex and cardinal margins, more abruptly to the lateral margins; mesial fold commencing at a little above the middle and often becoming prominent at the front; beak small and nearly straight.

Surface marked by from ten to twelve rounded or subangular plications, which become obsolete on the upper portions of the valves. The mesial fold is composed of three plications much more prominent than the others. In the sinus there are three plications smaller than the others; the two plications bordering the sinus larger than those on other portions of the shell.

The specimens observed have a length of 9 or 10 mm., and a width of from 7 to 9 mm; a transverse section broadly oval, having a width of 5 or 6 mm.

This species is easily distinguished from any other of this formation at present known. The outline is very similar to some of the forms of *R.* (*Stenochisma*) *eximia*, of the Chemung group, but the shell is smaller, the plications of the fold and sinus are fewer and the plications become obsolete on the upper half of the valve.

Formation and locality. Clinton group, limestone, two miles south-west of Bell's mills, Blair county, Pennsylvania.

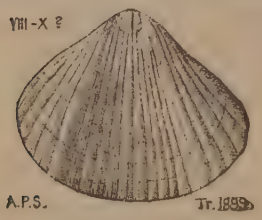
RHYNCHONELLA MEDIALIS Simpson, n. sp., Fig. 9.

Shell broadly oval or subtrigonal in outline; height a little less than the width; greatest width about two-thirds the length of the shell from the beak. Margins from the apex to the widest portion of the shell nearly straight, then abruptly rounding and slightly produced in front in a broad extension.

Ventral valve convex at the sides, depressed in the middle; mesial sinus commencing at the apex and growing wider to the base, where it occupies fully one-half of the width of the valve.

Dorsal valve unknown.

Surface marked by about twenty plications, of which eleven occupy the mesial sinus, and are smaller than those on other portions of the valve, there being five in the same space occupied by three of the others; plications rounded or subangular. There are also very fine radiating striæ covering the plications, four or five in the space of 1 mm. The plications are crossed by lines or varices of growth. No concentric striæ have been observed, though they may occur on more perfectly preserved specimens.



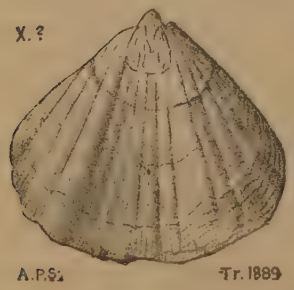
The specimen from which the above description was taken has a height of 25 mm., and a width of 30 mm.

This species is associated with *Rhynchonella* ———, but may be readily distinguished by its size and the much larger number of plications in the mesial fold. The only species approaching it in that respect is *R.* (*S.*) *venustula*, of the Hamilton group, but they are so unlike in other respects that there will be no difficulty in distinguishing them.

Formation and locality. Waverly group, near Warren, Warren county, Pennsylvania.

RHYNCHONELLA STRIATA Simpson, n. sp., Fig. 10.

Only the ventral valves of this species have been observed, but they differ so much from known forms that it is necessary to consider them as belonging to a new species.



Shell subtriangular ovate, apex pointed; length and width about equal. Margins from the apex to below the middle nearly straight, broadly rounding below, and at the base produced in a broad extension.

Ventral valve convex at the sides, depressed at the middle. Mesial sinus beginning near the apex and continuing to the base, becoming very broad as it approaches the front.

Surface marked by thirteen plications, of which five occupy the mesial sinus, the three central ones being larger than the outer ones, but all smaller than those on the other portions of the shell; plications subangular or angular. There are also very fine radiating striæ on the plications, three in the space of 1 mm. The plications are crossed by fine concentric striæ, which are most prominent on the front of the valve, becoming obsolete above, and also by stronger imbricating lines or varices of growth.

The specimens observed have a height of about 35 mm.; width just below the middle equal to the height.

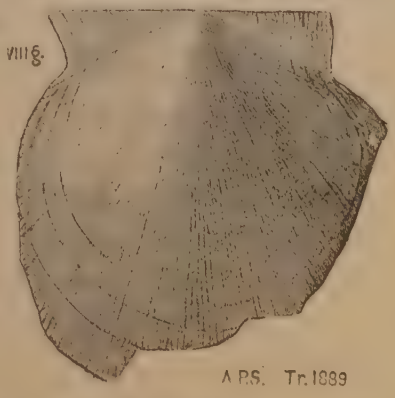
This species may be distinguished from any other of this formation by its large size, deep sinus and radiating striations. This species closely resembles *Rhynchonella missouriensis* of the Kinderhook group, but the shell is larger, the apex more pointed, giving an angular appearance to the upper portion of the shell, and the greatest width is below the middle.

Formation and locality. Waverly group, four miles south-west of Warren, Warren county, Pennsylvania.

AVICULOPECTEN ÆQUALATA Simpson, n. sp., Fig. 11.

Shell of medium size, equilateral, not oblique, nearly circular; length a little more than the width; basal and lateral margins below the ears regularly and broadly rounded.

Left valve flattened; greatest convexity a little more than one-fourth the length of the shell from the beak; very gradually sloping to the lateral and basal margins.



Right valve unknown.

Hinge line straight; length a little more than two-thirds the width of the shell, central, not extending as far as either lateral margin.

Beak obtuse, rounded, straight; umbo prominent, well defined by its slightly gibbous form and its rapidly sloping sides.

Ears subequal, narrow, triangular, and each separated from the body by a narrow sinus; lateral margins convex.

Surface ornamented by narrow but distinct rays of essentially uniform size; at the base there are six or seven in the space of 5 mm.; a little above the middle of the shell there are twelve in the same space; interspaces wider than the rays. The

rays are crossed by fine, concentric, crenulating striæ, which become fasciculated on the anterior ear. Near the base there are frequent concentric undulations.

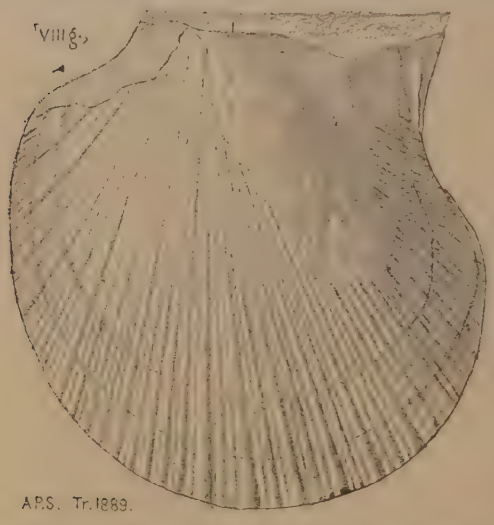
The specimen from which the description was made measures as follows: height 50 mm.; width 50 mm.; length of hinge line 35 mm.

Formation and locality. Chemung group, one mile north of Warren, Warren county, Pennsylvania.

LYRIOPECTEN ALTERNATUS Simpson, n. sp., Fig. 12.

Shell large, broadly ovate, nearly circular; height about equal to the longitudinal diameter; basal and lateral margins regularly rounded.

Left valve moderately convex; greatest convexity above and a little anterior to the middle, gradually sloping to the base, more abruptly curving to the cardinal and antero-basal margins.



Right valve unknown.

Hinge line straight, length a little more than one-half the transverse diameter of the valve.

Anterior ear short, triangular, not well defined; posterior ear triangular, flat; limits not well defined except near the beak; margin slightly concave, nearly straight; extremity angular.

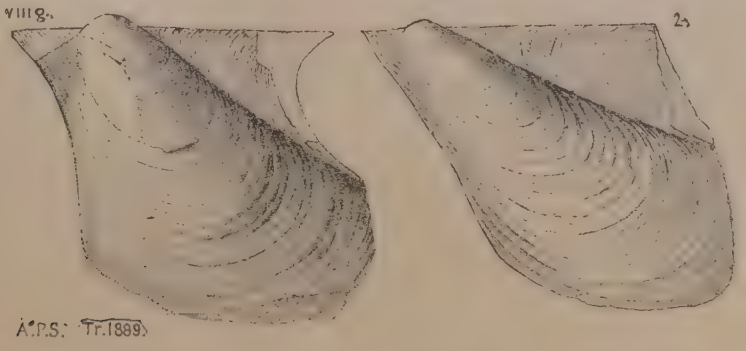
Surface marked by more than thirty comparatively strong, sharply rounded rays; between adjacent prominent rays are usually three smaller rays, the central one of which is larger than the others, occasionally nearly as prominent as the principal ones; the other two are much finer. On and near the posterior ear, and also near the anterior, this disposition is not conspicuous, the radii being more nearly of the same size. The radii are crossed by occasional lines of growth. No concentric striæ have been observed.

This species somewhat resembles *Lyriopecten tricostatus* of this formation, but may be distinguished by its more nearly circular form, by the greater number of and less prominent radii, and the stronger central one of the three intermediate striæ; from *L. magnificus* and *L. macrodontus* by its smaller size and the decided difference in the ornamentation of the surface.

Formation and locality. Chemung group, one mile north of Warren, Warren county, Pennsylvania.

LEPTODESMA LEIOPTEROIDES Simpson, n. sp., Fig. 13.

Shell above the medium size, subrhomboidal; body elongate ovate, oblique at an angle of about fifty degrees to the hinge line; height a little less than two-thirds the



length; antebyssal margin rounded, much constricted at the byssal sinus, then broadly rounding, somewhat abruptly recurving at the postbasal extremity.

Left valve gibbous above the middle, becoming flattened on the postero-basal portion. Right valve unknown.

Hinge line straight, length unknown, as a perfect specimen has not been observed.

Beak subanterior, prominent, oblique, directed forward; umbonal region gibbous, descending more abruptly on the posterior than on the anterior side.

Anterior end short, angular at the extremity, rounded below, separated from the body by a distinct, nearly vertical byssal depression. Wing narrow, triangular, joining the body at a little more than one-third the length of the valve from the posterior extremity; margin oblique below, becoming deeply concave and abruptly curving backward, and probably produced in a spiniform extension.

Surface marked by concentric striæ which are most distinct on the wing near the body, being often fine, sharp, and lamellose in appearance; frequently on the body becoming fasciculated and producing an undulated surface. The wing is separated from the body by a well-defined, narrow groove, which regularly curves inward from the beak to the junction of the wing with the body.

The specimens vary in proportional height and length; two left valves having respectively a length of 60 and 50 mm. and a height of 40 and 45 mm. The width of the body of the longer specimen at the junction of the wing with the body is 30 mm., of the shorter one 35 mm.

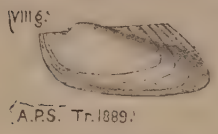
The specimens usually have somewhat the appearance of the genus Leiopteria.

Some of the specimens resemble *Leptodesma billingsi* of this formation, but may be distinguished from that species by the greater width of the lower portion of the body, the larger wing and the very distinct separation of the body and wing.

Formation and locality. Chemung group, near Warren, Warren county, Pennsylvania.

LEPTODESMA PARALLELUM Simpson, n. sp., Fig. 14.

Shell small, slightly oblique; body ovate; the basal margin frequently nearly parallel with the hinge line; length usually a little more than twice the height; anterior margin rounded; basal margin nearly straight, a little constricted anterior to the middle; abruptly recurving at the postero-basal extremity; the posterior margin being obliquely truncate.



Left valve convex, greatest convexity at the umbonal region, becoming flattened at the postero-basal portion.

Right valve a little more convex than the other but not gibbous.

Hinge line straight, length about three-fourths that of the shell.

Beak about one-fourth the length of the shell from the anterior end, prominent, directed forward; umbonal region convex, descending much more abruptly on the posterior than on the anterior side.

Anterior end short, angular at the extremity, rounded below. A depression extends from near the beak to the basal margin a little anterior to the middle. Wing very narrow, triangular, joining the body nearly at the posterior extremity; margin of wing straight, oblique; extremity obtusely angular. The wing is distinctly separated from the body.

Surface marked by concentric striæ, which frequently fasciculate on the anterior portion of the shell. There are also concentric undulations.

This species most closely resembles *Leptodesma propinquum*, but the wing is more distinctly separated from the body, and the body is much less oblique, the basal margin being sometimes nearly parallel with the hinge line; this latter feature will serve to distinguish it from any other species at present known. When a little covered by the rock it might easily be mistaken for some form of Sphenotus.

Formation and locality. Chemung group, hill north of Warren, Warren county, Pennsylvania.

PTYCHOPTERIA OBSOLETA Simpson, n. sp., Fig. 15.

Shell of medium size, subrhomboidal in outline; body ovate oblique, at an angle of about forty degrees to the hinge line; height about three-fourths the length. Anterior margin abruptly rounded; basal margin curved outward at the extremities, concave at the middle; posterior margin somewhat abruptly recurved.

Right valve unknown. Left valve moderately convex; greatest convexity at the umbonal regions.

Hinge line essentially straight; length a little less than that of the body.

Beak situated at about the anterior fourth of the shell, small, extending beyond the hinge line. A shallow broad sinus extends from the beak to the basal margin a little anterior to the middle.

Anterior extremity acuminate, margin rounded.

Wing triangular, joining the body at the posterior extremity; margin for a short distance straight, then abruptly curving forward, and just before reaching the cardinal line curving upward. Wing convex; flattened immediately below the cardinal line; separated from the body by a narrow but conspicuous depression.

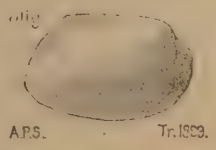
Surface ornamented by faint radiating striæ, which are obsolete, except on perfectly preserved specimens, and also by fine concentric striæ, which frequently become fasciculate on the anterior portion of the shell.

This species may be distinguished from any other at present known by the slight obliqueness of the body of the shell, the basal margin being nearly parallel with the hinge line; the margin is decidedly convex; in nearly all other species it is straight or concave; the wing extends beyond the body of the shell. The outline is very similar to that of some forms of the genus Cypricardinia.

Formation and locality. Chemung group, hill north of Warren, Warren county, Pennsylvania.

MODIOMORPHA RIGIDULA Simpson, n. sp., Fig. 16.

Shell of medium size or smaller, subquadrangular in outline; height a little more than three-fifths the length of the shell; basal margin regularly and gently curving from the anterior to the postbasal extremity; posterior margin gently curved, slightly oblique, sometimes nearly at right angles to the basal margin; cardinal line essentially straight; anterior rounded abruptly, extended, without limitation by a sinus.



Beaks a little more than one-fourth the length of the shell from the anterior end; umbonal ridge prominent, extending from the beaks to the postbasal extremity. Valves convex towards the basal margin, becoming gibbous above the middle and in the umbonal region; posterior slope convex near the beaks, becoming flattened as it approaches the posterior margin.

Surface marked by concentric striæ which frequently become obsolete on portions of the shell.

On casts of this species the pallial line is sometimes so strong as to give a distorted appearance to the specimen.

This species may be distinguished from *Modiomorpha rigida*, of this formation, by its greater gibbosity, the less oblique posterior margin, less clearly defined umbonal ridge, and the more prominent beaks.

Formation and locality. Chemung group, Tioga village, Tioga county, Pennsylvania.

MODIOLOPSIS SUBRHOMBOIDEA Simpson, n. sp., Fig. 17.

Shell of medium size, rhomboid ovate in outline; length twice the height; basal margin slightly convex along the middle, curving to the extremities; posterior margin abruptly rounded below, somewhat more gradually recurving to the cardinal line; cardinal margin slightly arcuate; anterior margin sharply rounded.

Valves flattened, greatest convexity at the umbonal ridge.

Hinge line slightly oblique, extending a little more than two-thirds the length of the shell.

Beaks appressed, situated about one-fourth the length of the shell from the anterior end; umbonal ridge not distinctly defined; posterior slope rounded, becoming flattened just before reaching the cardinal line.

Surface marked by fine concentric lines, and at irregular distances apart by varices of growth.

The anterior muscular impression is moderately large, well marked, and situated just within the anterior margin below the beak. The best preserved specimen has a length of 24 mm., and a height of 13 mm.

This species may be distinguished from *M. subcarinatus* by the less clearly defined umbonal ridge, the somewhat arcuate hinge line, and the absence of a constriction in the basal margin.

Formation and locality. Clinton shale, above fossil ore, at McKee's ore bank, north-east of McKee's house, Ferguson valley, seven miles north-west of Lewistown, Mifflin county, Pennsylvania.

GONIOPHORA CURVATA Simpson, n. sp., Fig. 18.

Shell trapezoidal, medium size or smaller; length usually about twice the height, sometimes a little less; anterior end rapidly declining from the beaks, abruptly rounded below; basal margin gently rounding, sinuate a little anterior to the middle;

posterior margin obliquely truncate; cardinal line very slightly oblique, straight; hinge line about two-thirds the length of the shell.

Valves convex below the umbonal ridge, gibbous in the umbonal region; umbonal slope flat or a little concave.

Beaks at the anterior end, acute, incurved; umbonal ridge very prominent, angular, extending from the beak to the basal extremity, curved. Along the middle of the posterior slope is a low rounded or subangular ridge, moderately conspicuous.

Test marked by concentric striæ, which become fasciculate on that portion of the shell below the umbonal ridge. The test is raised in a crest along the umbonal ridge.

Anterior muscular impression situated at the anterior edge, ovate width two-thirds the length; pallial line near to and parallel with the basal margin, appearing as a shallow groove on the casts; posterior muscular impression not observed.

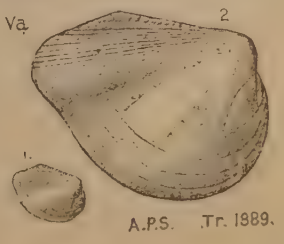
A specimen of medium size has a length of 40 mm., and a height of 18 mm. Other specimens preserve about the same proportion.

This species closely resembles *Goniophora truncata* of the Hamilton group, but the hinge line is much longer, and the posterior margin correspondingly less oblique. From *Goniophora chemungensis* it is distinguished by its smaller size, more distinctly curved umbonal ridge, and the ridge along the middle of the umbonal slope; from *G. perangula* by the less angular form of the shell, the much less oblique posterior margin, and the ridge on the posterior slope; from *G. subrecta* by its much smaller size and the ridge on the posterior slope.

Formation and locality. Chemung group, near Warren, Warren county, Pennsylvania.

NUCULA SINUOSA Simpson, n. sp., Fig. 19.

Shell small, ovate cuneate in outline, subnasute behind; height varying from one-half to two-thirds the length, usually slightly more than one-half; anterior and middle portions of the basal margins rounded, somewhat abruptly constricted towards the posterior end; posterior margin obliquely truncate; anterior end abruptly rounded; cardinal line, anterior to the beak, sharply declining; more gradually sloping to the posterior.



Valves slightly convex, greatest thickness of the shell a short distance below the umbo.

Beaks from one-third to three-fifths of the length of the shell from the anterior end, extending above the hinge line, compressed, sharp, not prominent.

Umbonal ridge distinctly defined, subangular, with a shallow depression below it, which is most conspicuous at the postbasal margin, becoming obsolete on the upper half of the shell; posterior slope marked by fine, sharp, slightly divergent striæ. There are also fine concentric striations, which on the specimens observed are obscure, the surface appearing smooth.

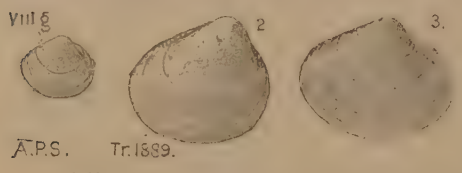
Hinge line marked by frequent crenulations.

Three specimens measured have each a length of 10 mm.; height varying from 5 to 7 mm.

In the striation of the posterior slope this species resembles *Nucula poststriata*, of the Trenton and Hudson River groups, but may be distinguished from that species by its less gibbous form, the constriction of the postbasal margin, and the conspicuous depression below the umbonal ridge.

Formation and locality. Clinton group, McKee's ore bank, seven miles northwest of Lewistown, Mifflin county, Pennsylvania.

NUCULA SUBTRIGONA Simpson, n. sp., Fig. 20.



Shell somewhat variable in form, usually subtrigonal; length and height about equal; basal margin regularly rounded, not constricted toward the posterior end; posterior margin rounded or obscurely truncate; anterior margin abruptly rounded; cardinal line very abruptly declining anterior to the beak, more gradually declining to the posterior.

Valves slightly convex, somewhat flattened as they approach the basal margin.

Beaks about one-third the length of the shell from the anterior end, not prominent, compressed, extending above the hinge line; umbonal ridge obscure, very slightly arching upward; posterior slope very narrow, rounded.

Surface marked by fine concentric striæ and occasional varices of growth. The concentric striæ are often very obscure, the shell appearing essentially smooth.

Hinge line, posterior to the beak, marked by a row of fine transverse teeth.

Three specimens representing the extremes in form measure respectively 10, 4 and 4 mm. in length, and 10, 3 and 2 mm. in height. Larger specimens occur.

This species may easily be distinguished from *N. sinuosa* by the absence of a constriction in the basal margin, furrow below the umbonal ridge and striæ on the posterior slope.

Formation and locality. Chemung group, north of Blacklog creek, Orbisonia, Huntingdon county, Pennsylvania.

TELLINOMYA (PALÆONEILO) CUNEATA Simpson, n. sp., Fig. 21.

Shell small, ovate cuneate in outline; length twice the height; basal margin broadly rounding, becoming constricted or arcuate at about one-third the length of the shell from the anterior end; posterior margin short, obliquely truncated; cardinal line essentially straight, sloping at nearly the same angle anteriorly and posteriorly to the beaks; anterior end large and regularly rounded.

Greatest convexity of the valves above the middle and in the umbonal region. Beaks about central, slightly incurved, extending a little above the hinge line; umbonal ridge clearly defined, subangular; posterior slope declining regularly and abruptly to the cardinal line. Below the umbonal ridge there is a broad shallow depression, extending from near the beaks to the base and constricting the basal margin.

Surface marked by strong, lamellose, concentric striæ at regular distances apart, and by very fine concentric lines between the lamellose striæ.

On the specimens observed there are eight or nine transverse teeth on each side of the beak.

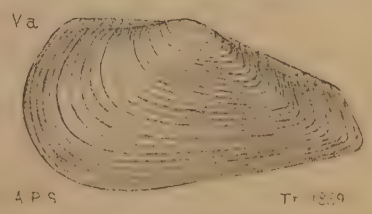
The specimens measured have a length of 12 mm., and a height of 6 mm.

This species may be distinguished from *T.* (*P.*) *diminuens* of this formation by its smaller size, more distinct lamellose striations and the less abrupt constriction of the posterior portion.

Formation and locality. Clinton group, seven miles north-west of Lewistown, Mifflin county; and north of Blacklog creek, Orbisonia, Huntingdon county, Pennsylvania.

TELLINOMYA (PALÆONEILO) DIMINUENS Simpson, n. sp., Fig. 22.

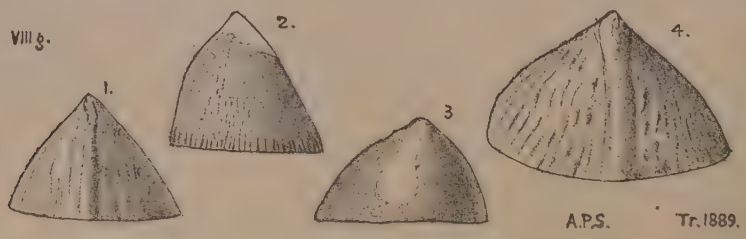
This species is very similar to the preceding, but is usually larger, the specimens observed having a length of from 23 to 25 mm., and a height of 11 or 12 mm. The posterior portion is more abruptly constricted, the lamellose striations are not so prominent and are more closely arranged.



Formation and locality. Clinton group, McKee's ore bank, north-east of McKee's house, Ferguson valley, seven miles north-west of Lewistown, Mifflin county, Pennsylvania.

PLATYCERAS BREVE Simpson, n. sp., Fig. 23.

Shell of medium size, apex not incurved; body straight; rapidly increasing in size; width at the base equal to the length of the anterior side; length of the poste-



rior side from two-thirds to four-fifths that of the anterior; both sides convex; on the anterior side there is a prominent subangular elevation, commencing at the apex and continuing to the base; on each side of the carina a slight depression; other portions of the shell without plications or elevations.

Aperture circular; peristome, as far as can be ascertained, not sinuous.

Surface marked by elongate pustules, subregularly arranged, giving to the surface the appearance of being coarsely striated, three in the space of 5 mm. There are also faint indications of concentric striæ.

A specimen of average size measures as follows: Diameter of aperture 23 mm.; length of the anterior side 20 mm.; of posterior 15 mm.; height 15 mm.

The characteristics of this species are the short conical form, the rapid enlargement from the apex to the base, and the elongate pustules of the surface.

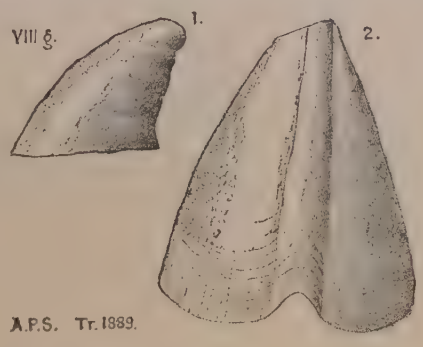
From those species having a carina it is distinguished as follows: From *Platyceras carinatum* by its conical form, the straight apex, the absence of plications and the non-sinuosity of the peristome; from *Platyceras mitelliforme* by its larger size, conical form and the ornamentation of the surface; from *Platyceras conicum* by its shorter form and the absence of conspicuous plications and the consequent non-sinuosity of the peristome. It most closely resembles *Platyceras dorsale* of this formation, but it is shorter, much less oblique; posterior side straight or convex; the apex more central and does not project beyond the base, while in that species the apex projects beyond the base a distance nearly equal to half the diameter of the aperture.

Formation and locality. Chemung group, near Warren, Warren county, Pennsylvania.

PLATYCERAS DORSALE Simpson, n. sp., ig. 24.

Shell obliquely subconical; anterior side curved; posterior straight or concave; apex not incurved, laterally compressed; body of the shell regularly increasing in

size, rounded; width at the base equal to three-fourths of the length of the anterior side; length of the posterior side one-half that of the anterior; right and left side usually equally developed, but on one specimen the right side has a little the greater development. On the anterior side there is a conspicuous rounded or subangular elevation extending from the apex to the base; on the posterior side is an elevation beginning at about one-half the length of the side from the apex, and continuing to the margin; on each side of this elevation a comparatively broad shallow depression, of the same extent as the elevation.



Aperture circular; peristome slightly sinuous at the elevations.

Surface marked by fine radiating lines; at the base there are three in the space of 1 mm., above they are much more closely disposed; the radii are crossed by fine concentric striæ; the surface presenting a cancellated appearance when the specimen is well preserved.

One specimen measures as follows: Length of the anterior side 32 mm., of posterior 18 mm., height of shell 18 mm. Another specimen, which probably belongs to the same species, is flattened, but that may be due to pressure; it measures as follows: Length of the anterior side 45 mm., of the posterior 22 mm., width at the base 35 mm.; height of shell 18 mm.

This species most closely resembles *Platyceras breve* of the same locality, but the anterior side is much longer and the posterior side proportionally shorter, the shell more oblique and not so regularly conical; it has an elevation and two depressions on the posterior side, and the surface has fine radiating striæ, the surface of *P. breve* being marked by elongate pustules; from *Platyceras striatum* it may be distinguished as follows: It is more oblique, the posterior and anterior sides are more unequal, and it is without the conspicuous plications characteristic of that species. It resembles *Platyceras mitelliforme* in having a prominent carina, but it is a larger form and the apex is not bent or incurved. From *Platyceras conicum* it may be distinguished by the absence of conspicuous plications; and from *P. carinatum* by the straight apex and the absence of conspicuous plications.

Formation and locality. Chemung group, three miles north-west of Warren, Warren county, Pennsylvania.

PLATYCERAS INÆQUALE Simpson, n. sp., Fig. 25.

Shell small, subangularly ovate; apex minute, incurved, making less than one turn, very thin and angular; inclined or twisted to the right. The body of the shell expands rapidly; anterior side curved, sometimes forming nearly half a circle; posterior side also curved, but in a lesser degree; width of base from one-half to three-fourths the length of the anterior side; posterior side one-third the length of the anterior.

The left side is flattened or only very slightly convex, and is often nearly or quite at right angles to the base, making a sharp angle or ridge between the side and the back of the shell. The right side is convex and much more developed than the left. In front the shell becomes flattened near the margin. On the left side, about half way between the base and angular carina, there is a low rounded ridge, commencing near the apex and continuing the length of the shell, though this feature in many of the specimens is obscure.

Aperture circular or broadly oval.

Most of the specimens observed are casts or macerated so that the surface characters are obsolete. On some of the specimens there are evidences of strong radiating striæ or elongate pustules, and when well preserved there are numerous concentric striæ.

The characteristics of this species are the pinched appearance of the apical portion, and its inclination to the right, and the much greater development of the right side; in the latter feature it resembles *Platyceras cymbeum*, but it is a much smaller shell, and the plications are very much less prominent; from *Platyceras mitelliforme* it may be distinguished by the inequality of its sides, in that species the prominent ridge being in the middle of the shell, both sides being equally developed.

Formation and locality. Chemung group, four miles north-west of Warren, Warren county, Pennsylvania.

PLATYCERAS MITELLIFORME Simpson, n. sp., Fig. 26.

Shell small, obliquely arcuate from the base; apex incurved, making part of one volution; below which the body volution rapidly increases in size. Width at the base equal to three-fourths the length of the anterior side; length of the posterior side less than one-half of the anterior; right and left sides equally developed.

Anterior side convex, with a prominent, broad, rounded carina along the middle;

on each side of the carina, towards the base, a shallow depression. On some of the specimens there are indications of very slight plications on the posterior side.

Aperture oblique, broadly elliptical; peristome a little sinuous at the carina, and sometimes slightly sinuous, corresponding with the faint folds of the posterior side.

Surface marked by concentric lines and by broad undulations, which sometimes give to portions of the shell a lobed appearance.

A specimen of about the average size measures as follows: Height 12 mm.; length of the anterior side 25 mm.; of the posterior 8 mm.; width at base 22 mm.; thickness 18 mm.

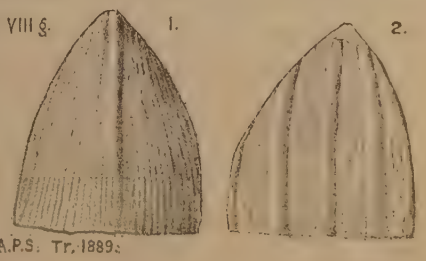
The characteristic feature of this species is the prominent carina or elevation along the dorsum.

It may be distinguished from *Platyceras inæquale* of this formation by its somewhat larger size, the prominent carina, and the equal development of the right and left side; from *Platyceras dorsale* by its smaller size, its flattened form (a transverse section being oval), and by the partial volution of the apex; from *Platyceras* (*Orthonychia*) *striatum* by its arcuate form, the prominent carina and the absence of conspicuous plications; from *Platyceras carinatum* by the equal development of the right and left sides, and the absence of conspicuous plications; from other species at present known, by its small size, decidedly curved form, and prominent carina.

Formation and locality. Chemung group, near Warren, Warren county, Pennsylvania.

PLATYCERAS STRIATUM Simpson, n. sp., Fig. 27.

Shell subconical; apex not incurved or bent; body essentially straight; sides a little curved from the base to the apex; right and left sides equally developed; width at the base, length of anterior and posterior sides equal. On the anterior side is a narrow, angular, conspicuous carina, extending from the apex to the base; on the posterior side are three oblique, broad, prominent, rounded ridges, with depressions between them, which are wider than the ridges.



Aperture oval. The bases of all the specimens observed are attached to the rock so that the form of the peristome can not be definitely ascertained.

Surface marked by comparatively strong, radiating striæ, which are sometimes continuous, at other times interrupted, then having the appearance of very elongate pustules; at the base about six in the space of 5 mm. No concentric striæ have been observed, though it is possible that they exist on more perfectly preserved specimens.

A typical specimen measures as follows: Width at the base 30 mm.; thickness 20 mm.; height 30 mm.; width of sides equal; width of ridges on posterior side 3 mm.; of depressions slightly more; of carina 3 mm.

This form resembles the two specimens which are figured in the Pal. of New York, Vol. V, Pt. II, Pl. I, Figs. 20–23, which differ materially from the other figured specimens placed under that species. The other specimens, though perfectly preserved and showing concentric striæ, have no indication of radiating striæ, while in the specimens described they are one of the most characteristic features; they are also shown in the figures mentioned above. The plications are also stronger and the form more regularly conical.

This species resembles *P. striatum* from this formation, but may be easily distinguished by its straight form, the equal length of the sides, the coarser striations, and the strong plications of the posterior sides; from *P. breve* it is distinguished by its more elongate form, oval aperture, more continuous radiating striæ, and the conspicuous plications of the posterior side.

Formation and locality. Chemung group, four miles north-west of Warren, Warren county, Pennsylvania.

PLATYCERAS VARIANS Simpson, n. sp., Fig. 28.

Shell small, subconical, curved, slightly oblique; apex not incurved or bent; width at the base two-thirds the length of the anterior side, and about equal to the posterior.

Plications frequent, variable in number. On the dorsum there is sometimes a faint indication of a carina; on the left side is a deep conspicuous furrow, which extends about three-fourths the length of the shell from the base; beyond this there is a slighter furrow; the area between them elevated, rounded and very prominent. On the posterior side of the shell are usually two or three slight furrows, but occasionally a stronger one, and on the left side there is one nearly as strong as on the opposite side. Sometimes on the posterior side the area between two of the smaller furrows is elevated, having the appearance of a ridge or carina, which is occasionally prominent.

The deep furrows on the right and left sides of the shell appear to be constant features, the others are somewhat variable.

Aperture broadly oval, nearly circular; peristome concealed on all the specimens observed, so that its true form can not be ascertained.

All the specimens occurring in the form of casts, the surface markings are obsolete.

This species may be distinguished from *Platyceras mitelliformis* by its straighter form, absence of a prominent carina, and by its conspicuous plications; from *P.* (*O.*) *striatum* by its smaller size, more frequent plications, and the absence of radiating striæ, the convexity of the anterior side and the concavity of the posterior; from *Platyceras inæquale* by its equally developed right and left sides and its conspicuous plications; from *P.* (*O.*) *breve* by its curved, more slender form, and plications; from *Platyceras dorsale* by its smaller size and conspicuous plications; from *P.* (*O.*) *attenuatum* by the straight apex and the strong lateral furrows; from *Platyceras carinatum* by the absence of a prominent carina and by the conspicuous lateral furrows; from *P.* (*O.*) *conicum* by its smaller size and curved form.

Formation and locality. Chemung group, four miles north-west of Warren, Warren county, Pennsylvania.

ACERVULARIA COMMUNIS Simpson, n. sp., Fig. 29.

Growing in large convex or globular masses; under side covered by a wrinkled epithecal crust. Stems multiplying by gemmation from the calyces; usually in contact, but sometimes free and circular.

Calyces in contact, polygonal, generally pentagonal or hexagonal; surrounded by acute, linear, crested edges; diameter a little variable, but usually about 5 mm. Sides of calyces abruptly curved downward to the central cavity.

Rays thin, sharp; about thirty in number; alternately long and short, but of uniform size at the margins of the calyces. Diaphragms thin.

Formation and locality. Lower Helderberg group, from A. B. Miller's farm, Warrior ridge, Barree township, Huntingdon county, Pennsylvania.

CLADOPORA RECTILINEATA Simpson, n. sp., Fig. 30.

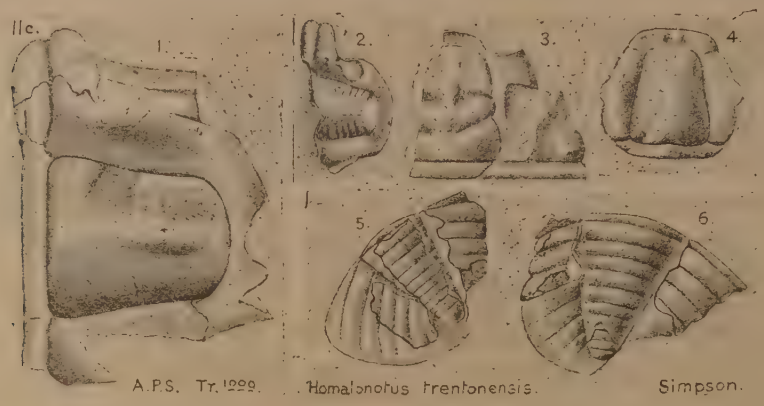
Zoarium ramose, bifurcating, rarely anastomosing; diameter of branches from 1.50 to 3 mm.

Cells tubular, nearly at right angles to the axis; rapidly increasing in size to the aperture; apertures arranged in regular longitudinal rows, which are sometimes separated by a slight ridge; from five to nine rows on a branch; from eight to ten apertures in the space of 5 mm. longitudinally; diameter of an aperture from .33 to .40 mm. Lips prominent, in well-preserved specimens, projecting over the aperture, and giving to the cell-tubes the appearance of opening very obliquely.

This species somewhat resembles *C. multipora*, but the branches are smaller and straighter, and the cell apertures are much more regularly arranged in parallel, longitudinal rows; in its size and manner of growth it is very similar to *C. macrophora*, but the surface of that species has not been observed, so no comparisons are possible.

Formation and localities. Lower Helderberg group, one and a-half miles south of Rock Hill furnace, Orbisonia, Huntingdon county; also north of Tyrone City, Blair county, Pennsylvania.

HOMALONOTUS TRENTONENSIS, Simpson, n. sp., Fig. 31.



The figures represent a few of many specimens in the State Collection, found by Mr. C. E. Hall in strata of the Trenton group, cropping out just above the milldam at Reedsville, in Mifflin county, Pennsylvania.

ARTICLE IX.

THE MAMMALIA OF THE UINTA FORMATION.

PART I. THE GEOLOGICAL AND FAUNAL RELATIONS OF THE UINTA FORMATION.
PART II. THE CREODONTA, RODENTIA AND ARTIODACTYLA.

BY WILLIAM B. SCOTT,
PROFESSOR OF GEOLOGY IN PRINCETON COLL

PART III. THE PERISSODACTYLA.
PART IV. THE EVOLUTION OF THE UNGULATE FOOT.

BY HENRY FAIRFIELD OSBORN,
PROFESSOR OF COMPARATIVE ANATOMY IN PRINCETON COLLEGE.

ILLUSTRATED BY FIVE LITHOGRAPHIC PLATES AND THIRTEEN DIAGRAMS.

Read before the American Philosophical Society, May 17, 1889.

This memoir is principally descriptive of a collection made by the Princeton Scientific Expedition of 1886 in the Bad Lands of the White River, Northeastern Utah. The party was composed of Messrs. Reynolds, Harlan, Hervey, Baucus, Paton, Kane, all Princeton students, under the able leadership of Mr. Francis Speir, Jr., whose name is connected with so many important palæontological discoveries. The expedition experienced great difficulties in the field and some risk from the hostile threats of the White River Utes.

The collection has been skillfully prepared and mounted by Dr. Franklin C. Hill. The drawings are by Mr. Rudolph Weber.

Part I.

BY WILLIAM B. SCOTT

GEOLOGICAL AND FAUNAL RELATIONS OF THE UINTA FORMATION.

While the palæontological relations of the various series of Eocene deposits in the upper Green River valley are, for the most part, quite clear, the stratigraphical relations are as yet but imperfectly known, and leave many questions still open. Dr. White (No. 18, p. 35) believes that the entire series is conformably deposited: "In the great region now drained by the Green river, there are three well-marked groups of strata, that come in their order above the Laramie group, and which all agree in referring to the Tertiary period. These are the Wasatch, Green River and Bridger groups, named in ascending order. The Wasatch group is the lowest of a series of three fresh-water Tertiary groups, all of which are intimately connected, not only by an evident continuity of sedimentation throughout, but also by the passage of a portion of the molluscan species from one group up into the next above. Not only were the three groups, aggregating more than a mile in thickness, evidently produced by a continuous sedimentation, but it seems equally evident that it was likewise uninterrupted between the Laramie and Wasatch epochs, although there was then a change from brackish to fresh waters and a consequent change of all the species of invertebrates inhabiting these waters."

King, on the other hand (No. 6, p. 353 *et seq.*), adduces evidence to show, not only that the Wasatch and Laramie are very clearly separated by unconformities, but that the three Eocene series are likewise divided by lack of conformity with each other.

Palæontologically the arrangement of the series is less obscure, though if we accept White's view of a continuous sedimentation from the Laramie to the Bridger we shall meet with very formidable difficulties. Thus no place is left for the very peculiar and primitive fauna of the Puerco group, which is not at all represented in the northern basin; the same reasoning will apply to the transition fauna of the Wind River group, a formation estimated as being 1000 feet or more in thickness (St. John, No. 12, p. 260), but so far as is yet known confined to the Wind River valley. To assume that the Puerco is contemporaneous with the Wasatch, the Wind River with the Bridger, and the beds of the Bridger basin with those of the Washakie

basin, would involve very complicated hypotheses of barriers and migrations for which there is no present evidence. The fauna of the Wind River deposits has been shown by Cope (No. 1) to be intermediate between the Wasatch and the Bridger, mingling types which elsewhere are found only in one or other of these formations with some forms peculiar to itself. Thus such typically Wasatch genera as *Coryphodon*, *Phenacodus*, *Didymictis*, *Calamodon* and *Esthonyx* are associated with equally typical Bridger genera, *Palæosyops*, *Lambdotherium*, *Miacis* and *Microsyops*, while the earliest and smallest known member of the Dinocerata, *Bathyopsis*, is confined to these deposits. Thus the Wind River formation occupies the same intermediate position between the Wasatch and Bridger palæontologically as does the Green River stratigraphically. One is therefore led to infer with Cope (No. 2, p. 453) that the Green River and Wind River are parts of the same formation, though the entire absence of mammalian fossils from the former renders this determination somewhat uncertain. It may perhaps be objected to this view that in Southwestern Wyoming the Bridger beds lie conformably upon the Wasatch. This conformity is, however, not improbably deceptive, for the following reasons: (1) King states (No. 6, p. 380) that he has observed unconformities between the Wasatch and Green River beds. "In the region east of the Wasatch a large amount of the Vermilion Creek [Wasatch] series was left in a nearly horizontal position and the sediments there sank quietly through deep water upon an approximately level bottom, accumulating in strata nearly conformable with the underlying Vermilion Creek rocks. From the manner in which the rocks of the Green River group abut westward against the Vermilion beds, it is evident that there was in the region included between the Wasatch and Uinta a highland lifted above the lake of the Green River period." (2) The direct contact between the Wasatch and Bridger strata at the west of the Bridger basin takes place by the latter bed's *overlapping* the Green River and thus reaching the Wasatch. If we assume that the Green River shales represent a distinct series, this overlap can be explained only by supposing either that these beds had been swept away from the western part of the basin before the deposition of the Bridger series, or, what is much more probable, that a series of disturbances first contracted and then expanded the waters of the lake. (3) It is impossible to account for the faunal differences between the Wind River and the Wasatch on the one hand and the Bridger on the other on geographical grounds alone, as this area is encompassed both on the north and the south by typical Wasatch beds.

The balance of evidence would thus seem to point to the conclusion that the Wind River beds are to be regarded as forming the base of the Bridger series, and this view has the further advantage, that the Bridger, thus defined, is characterized

throughout by the presence of some form or other of the Dinocerata, and that this extraordinary group of animals is entirely confined to this formation.

A still more intricate and difficult problem is that with reference to the relations of the various areas of Bridger deposits (apart from the Wind River series) to each other. Of these areas there are three: (1) The Bridger basin west of the Green river; (2) the Washakie basin east of the same river, and (3) a small area to the southeast of the latter. Supposing the Bridger beds of the Washakie and Bridger basins to have been deposited conformably in the same lake which laid down the Green River series and to have been uplifted together with the Green River in a post-Bridger upheaval, it is not a little remarkable that erosion should have removed the Bridger from all parts save the middle of these two basins. The few observations which bear upon this point in the way of the dips of the two formations combine to indicate that the movement took place at the end of the Green River period, that the western lake [*i. e.*, the supposed extension of the Green River lake west of the Wasatch mountains] was extinguished by this upheaval, and that the waters of the period formed a lake of restricted area altogether within the basin of Green river. Even with this supposition, which I conclude to be the most probable until it may be varied by future evidence, there is left the shadow of a doubt, whether the three Bridger bodies which appear upon our map—that of the Bridger basin, the Washakie basin, and the region east of Vermilion creek—were parts of a continuous sheet, or whether they themselves were areas of special lakes in the same general basin, but characterized by great fauna resemblances." (King, No. 6, p. 396.)

The facts of stratigraphy, so far as at present known, leave this question an open one, but the assemblage of fossils seems to point to the conclusion that there were at least two distinct lakes, and these not contemporaneous, but successive, a conclusion which we have already indicated elsewhere (Osborn, No. 10, p. 13; Scott, No. 15). The faunal lists of the two basins seem to show that the Bridger contains slightly older deposits than the Washakie, though the two may be in part contemporaneous. Some of the differences to be noted are, no doubt, due in part to the fact that the Bridger basin has been much more frequently and thoroughly explored than the Washakie, and others probably to conditions of preservation, for within the limits of the Bridger basin there are localities and strata which are especially rich in certain sorts of mammals which elsewhere are much rarer. As an example of this may be mentioned the abundance of the lemuroids and other small mammals at Twin Buttes. Future explorations may perhaps therefore diminish the number of faunal differences between the two areas.

A striking fact is the greater richness and variety of the forms found in the

western basin, especially of the smaller mammals, the creodonts, lemuroids and insectivores, which are comparatively rare in the Washakie and very abundant in the Bridger. No tillodonts have yet been reported from the former. The perissodactyls are quite different. *Palæosyops* is somewhat less abundant in individuals in the eastern basin, but *P. major* and *paludosus* are both present, and there are in the Princeton Museum two undescribed species of this genus from the Washakie which differ markedly from any yet found in the Bridger, and one of them, by its great size, seems to approximate closely *Diplacodon*. *Hyrachyus* is represented by the same or similar species and in about equal numbers in both areas. On the other hand the Uinta rhinoceros *Amynodon* (= *Orthocynodon* nobis) is found only in the eastern region, and the same is almost certainly true of *Triplopus*, while *Colonoceras* occurs only in the Bridger basin. Among the artiodactyls the chief difference is to be found in the presence and frequency in the eastern basin of the large species of *Achænodon*, *A. insolens* and *A. robustus*. *Helohyus* and *Homacodon* have not yet been reported from this region, but as representatives of these series occur in the Uinta, we may confidently expect that they will be found in the Washakie.

Another striking difference between the two basins is to be found in the *facies* of the Dinocerata so common everywhere. The great variability of these animals precludes the making of any very sharp distinctions between those of the two areas, but in a general way and with some exceptions they are in rather strong contrast with each other. The prevailing type of skull in the Bridger basin is comparatively short and broad, the nasal tuberosities are of moderate size, the parietal protuberances are placed well forward, and the parieto-occipital crest is of moderate height. The Washakie forms have generally a long narrow skull, with very large nasal tuberosities, the parietal protuberances are placed far back, the parieto-occipital crest is very high; the cervical vertebræ in these species are also as a rule shorter than in those of the Bridger area, and the animals tend to become of a larger size.

Making all due allowance for sources of error, it is difficult to believe that these differences are to be explained by geographical considerations, while on the other hand the stratigraphical relations of the Washakie beds to the underlying Green River series present objections to the assumption that the latter could have been a land surface for any great length of time. But these relations are by no means clear and very much need to be re-examined.

We have no information relative to the small area east of Vermilion creek, but in all probability it is simply an outlier of the Washakie.

From present knowledge, we are therefore justified in making a threefold subdivision of the Bridger epoch, with the Wind River beds at the base and the

Washakie at the top, and in regarding the Dinocerata as the group characteristic of the entire epoch. It is interesting to note that where the fauna of the Washakie basin departs from that of the Bridger basin, it does so in the way of resemblance to the Uinta.

The geology of the Uinta formation is even more imperfectly known than that of the earlier formations. Dr. White says of it (No. 18, p. 37): "Resting directly, but by unconformity of sequence, upon all the Tertiary or Cretaceous groups in the region surrounding the eastern end of the Uinta Mountain range, is another Tertiary group that has received the name of 'Uinta Group' from Mr. King, and 'Brown's Park Group' from Prof. Powell. It is possible that this group was deposited continuously, at least in part, with the Bridger group, but at the places where the junction between the two groups has been seen in this region, there is an evident unconformity, both by displacement and erosion." Dr. White has also informed us (orally) that the mollusca of these beds are strikingly different from those of the earlier Eocene. The Uinta deposits are composed of sandstones and clays much like those of the Bridger in appearance. They are of no great thickness and are best developed in the valley of the White River, a tributary of the Green, in eastern Utah and Western Colorado. The mammalian fauna of the Uinta formation, while very distinctly of more modern character than that of the Bridger, is nevertheless quite closely allied with it, more especially with that of the Washakie subdivision, and it should be further remembered that this fauna has as yet been only very partially explored, and we may therefore expect that future discoveries will fill up many of the gaps still existing.

The more extended study of this fauna confirms the generally accepted view that the Uinta group should be placed at the summit of the Eocene, forming the transition to the White River Miocene, with which it has many affinities. The most striking and obvious difference from the Bridger fauna consists in the absence of the great Dinocerata so characteristic of this series, of which no trace has yet been found, nor is it likely that they will be discovered in the future. If present at all, this group must have formed but a rare and unimportant factor in the assemblage of Uinta mammals. Another Bridger type of which no member has been discovered in the Uinta (with a possible exception hereafter to be mentioned) is that of the Tillodontia, which seem to have finally disappeared, unless, as some have supposed, we are to look for their successors in the Edentata. The smaller mammals are very much more scantily represented than in the Bridger, though some of this difference is perhaps due to conditions of preservation, as indeed the Uinta fossils are scantier and less well preserved than in the immediately preceding or succeeding epochs. A simi-

lar, though less striking, difference exists between the Bridger and Washakie basins with regard to the number and variety of the smaller forms. The great assemblage of lemuroids and pseudo-lemuroids which the Wasatch and Bridger show so abundantly is thus far represented in the Uinta only by the single species *Hyopsodus gracilis* Marsh; the Insectivora, Chiroptera, and Marsupialia have not been found at all, though there is hardly room for doubt that they existed, inasmuch as they occur both in the Bridger and the White River. Rodentia are also rare and only one form can be certainly named, a species of *Plesiarctomys*, which genus is abundant in the Wasatch, Wind River, and Bridger beds. A second species of rodent is apparently implied by a lower incisor with a fragment of the mandible; it is, however, much larger than any known rodent of the Bridger or White River, and may possibly belong to some tillodont; but this is not at all probable, as the tooth is much more like that of a rodent, besides being smaller than that of any Bridger tillodont. We have still therefore to search for the forerunners of the beavers, mice, and hares of the White River.

So far but a single creodont is certainly known to occur in the Uinta fauna, a very large species of *Mesonyx*. This family ranges therefore throughout the Eocene of North America, being represented by *Dissacus* in the Puerco, *Pachyæna* in the Wasatch and *Mesonyx* in the Bridger and Uinta. The absence of the upper molars from the specimen before us precludes the possibility of a final reference of it to *Mesonyx*; but there can be no doubt that it is a member of the family. A second creodont is perhaps indicated by a small lower sectorial molar and a premolar; if so, the animal must have belonged to the *Miacidæ*, or it may be a true carnivore. The creodont nature of the specimen is the more probable on account of the greater likeness of the Uinta fauna to the Bridger. In any case this animal very probably represents the forerunner of the dog-like forms of the White River, the so-called *Amphicyon* and *Galecynus*, and possibly of *Dinictis* as well. Nothing is as yet known of any Uinta forms which would serve to connect the hyænodonts of the White River with the *Oxyæna* and *Protopsalis* of the Bridger.

The Perissodactyla of the Uinta are of great interest, as they are plainly intermediate between those of the Bridger and those of the White River. The curious family of *Titanotheridæ* has its Uinta member in *Diplacodon*, which thus connects the Bridger genera *Palæosyops* and *Leurocephalus* with the *Titanotherium* (*Menodus*) of the White River. *Hyrachyus*, so frequent in the Bridger, has apparently disappeared, its place being taken by *Triplopus*, which already occurs in the Washakie beds, though sparsely. In the Uinta it is one of the most abundant of all the fossils, and is highly characteristic of the formation. Another genus, rare in the Washakie,

abundant in the Uinta, is the rhinoceros-like *Amynodon*, a hornless form which is followed in the White River by *Metamynodon* and *Aceratherium*. The Uinta tapir is *Iscotolophus*, which is as yet represented by a single abundant species of small size. This genus appears to be represented also in the Bridger, at least there is a well-preserved specimen in the Princeton Museum which we cannot distinguish from it, and seems to have its representative in the White River beds, which Dr. Leidy has doubtfully referred to *Lophiodon*, though only for the reason that the specimen, an isolated last lower molar, could not well be distinguished from the corresponding tooth of that genus. As Leidy has suggested, this specimen most probably belongs to a very different genus (No. 7, p. 239). The equine series is represented in the Uinta fauna by two species of *Orotherium* (*Epihippus*) which stands just intermediate between *Pliolophus* (*Orohippus*) of the Bridger and *Mesohippus* of the White River, though it also is found in the Bridger.

Perhaps the most striking change in the facies of the Uinta fauna as compared with that of the Bridger lies in the importance suddenly assumed by the selenodont artiodactyls. The Bridger is not known to contain any forms which can be strictly called selenodonts, though *Homacodon* and *Helohyus* are obviously commencing to develop this type of dentition. The Uinta contains at least two clearly marked genera of selenodonts, if not more, which are very rich in individuals and thus give a very different aspect to the fauna as a whole. Of these the most abundant is *Protoreodon*, the unmistakable ancestor of the *Oreodontidæ*, the peculiar family which is so eminently characteristic of the American Miocene. By the five-lobed construction of the upper true molars, *Protoreodon* indicates the line of connection with the bunoselenodonts of the earlier Eocene, especially, if we may judge from the molar teeth alone, with *Helohyus*. The other clearly defined Uinta selenodont is *Leptotragulus*, the most ancient unequivocal member of the Tylopoda and closely related to the White River genus *Poebrotherium*, though in many respects more primitive. The absence of the upper molars from our specimens prevents comparison of this type with *Homacodon*, from which it was perhaps derived. The Uinta has thus yielded forerunners of the two most important and characteristic groups of White River selenodonts; it remains for future investigation to bring to light the ancestors of *Leptomeryx* and *Hyopotamus*, though the latter is not improbably an immigrant from the Old World. No Bunodonta have as yet been found, and the origin of the White River genera, *Perchoerus*, *Entelodon*, etc., is still obscure. Our knowledge of the Bridger bunodonts is still very imperfect.

It will be evident from the above statements that the affinities of the Uinta fauna are most closely with the Bridger, as at least five genera are common to the

two horizons, *Plesiarctomys*, *Mesonyx*, *Triplopus*, *Amynodon* and *Orotherium*, while on the other hand no genus passes through from the Uinta into the White River, unless one agrees with Cope (No. 2, p. 455) in regarding *Metamynodon* as identical with *Amynodon*. While this is true, the Uinta fauna is no less clearly the forerunner of the White River fauna; what there are strong reasons for believing to be the ancestors of the hyracodonts, the titanotheria, the rhinoceroses, horses, tapirs, camels and creodonts, the dog-like carnivores, and the sciuromorph rodents of the White River, all are to be found. We cannot therefore agree with Schlosser (No. 13, p. 60) in regarding this formation as Oligocene, which in fact seems to be an unnecessary term in the classification of our Tertiary lacustrine deposits, the division between the uppermost Eocene, represented by the Uinta, and the lowermost Miocene, represented by the White River, being quite sufficiently clear.

The following partial list of genera will indicate the relations between these three formations. The Wasatch genera, which penetrate only into the Wind River beds, are omitted from the list:

Bridger.	Uinta.	White River.
Dinocerata		
Tillodontia		
Stypolophus		
Mesonyx	Mesonyx	
Miacis	? Miacis	
Oxyæna	?	Hyænodon
Protopsalis		
		Daphænus (Amphicyon)
		Cynodictis
		Dinictis
		Hoplophoneus
Antiacodon		
Anisacodon		
Passalacodon		
		Leptictis
Ictops	?	Ictops
Plesiarctomys	Plesiarctomys	Sciurus
		Gymnoptychus
		Heliscomys
		Ischyromys
Colonymys		Eumys
Mysops		Palæocastor
		Palæolagus
Omomys		
Hyopsodus	Hyopsodus	Laopithecus
Tomitherium	?	Menotherium
Limnotherium		
Microsyops		
Xiphacodon		Didelphys
Helohyus	Protoreodon	Oreodon
	?	Agriochœrus
Homacodon	Leptotragulus	Poebrotherium
Achænodon	?	Entelodon
		Perchœrus
		Leptochœrus
		Hyopotamus
		Leptomeryx
		Hypisodus
Lambdotherium		

Bridger	Uinta.	White River.
Palæosyops		
Telmatotherium	Diplacodon	Titanotherium
Isectolophus	Isectolophus	Mesotapirus
Hyrachyus		
? Triplopus	Triplopus	Hyracodon
Orotherium	Orotherium	
Pliolophus		Mesohippus
Colonoceras		
Amynodon	Amynodon	Metamynodon
		Aceratherium
Nyctilestes		Domnina
Vesperugo		
Nyctitherium		

Part II.

BY WILLIAM B. SCOTT.

THE CREODONTA, RODENTIA, AND ARTIODACTYLA.

PRIMATES.

HYOPSODUS GRACILIS Marsh.

This species is the only one of the pseudo-lemuroids which has as yet been reported from the Uinta deposits. This group is exceedingly abundant in the Bridger, especially in the Bridger basin; it has become more rare in the Washakie, and although the Uinta has yielded but one species as yet, others will no doubt be found. The change from the Bridger will, however, almost certainly remain a very striking one in the reduction of these animals. They are not certainly known to occur in the White River, though some specimens have been referred to the group (*Laopithecus*, *Menotherium*).

CREODONTA.

MESONYX Cope.

M. UINTENSIS Scott (No. 16, pp. 168, 169); Pl. X, Fig. 9. The specimen upon which this species is founded consists of five isolated lower molar and premolar teeth, an incisor, a canine, one upper premolar and fragments of the mandible, including the condyle. The reference to *Mesonyx* is somewhat uncertain on account of the absence of the upper molars; there can be no doubt, however, that the species belongs to the family *Mesonychidæ*, and it is of interest as being the largest and latest known member of that long-lived and most curious group of creodonts. This species may be distinguished from those of the earlier Eocene formations by very much greater size and by the fact that the anterior basal cusps of the lower molars are much reduced.

The incisor is peculiar and consists of a broad and rounded simple crown; it is of large size and contrasts strongly with the incisors of the Bridger species *M. obtusidens;* the canine and upper premolar differ from the corresponding teeth of the

Bridger species only in size. Since the first account of this species was written, we have found that the order of the teeth was there incorrectly given; what was there described as the second premolar being probably the third molar. The most anterior premolar of the lower series preserved in the specimen is probably the second (see Pl. X, Fig. 9). This is a relatively small tooth, implanted by two fangs and with a low, rather elongated crown, which consists of a median cone and faintly separated anterior basal tubercles; this tooth is therefore somewhat differently constituted from the second lower premolar of *M. obtusidens*, in which the anterior tubercle is not indicated at all, and the posterior one scarcely so. The fourth premolar has nearly the shape and size of the true molars, consisting of a high and massive, backwardly directed principal cusp, which is separated by a deep and narrow cleft from the large trenchant heel. The latter is as long from before backwards as the main cusp and is strongly convex on the outer side and concave on the inner. This tooth differs from the fourth premolar of *M. obtusidens* only in the absence of the anterior basal cusp. The first true molar has the same construction as the tooth just described, but is larger, and the main cusp is remarkably massive; there is an indication of the anterior basal cusp, but it is much less distinctly marked than in the Bridger species. This tooth is the largest of the series and considerably exceeds in size the lower sectorial of a full-grown lion. The second molar differs from the first only in being a little smaller and in the still greater reduction of the anterior basal cusps. The development of these cusps varies greatly in the different genera of the family; in *Dissacus* of the Puerco they are fairly well developed; in the Wasatch genus *Pachyæna* they are greatly increased in size, becoming as large as the heel, which gives the inferior molars a trifid appearance when seen from the side. In the Bridger species of *Mesonyx* these cusps become much smaller, being greatly exceeded in size by the talon, while in *M. uintensis* they have almost disappeared, entirely so in fact, from the fourth premolar. The third molar is very small, and is even more reduced in size than in *M. obtusidens*, which reduction chiefly affects the talon; in the Bridger species the talon is of good size, but in the specimen before us the heel is a mere rudiment. The main cusp is also more compressed and pointed. The third molar is very differently developed in the various genera of the family; in *Dissacus* and *Pachyæna* $\overline{\text{m. 3}}$ is nearly or quite as large as $\overline{\text{m. 2}}$; in *Mesonyx obtusidens* it is distinctly smaller, the proportions being 7 : 9, and in *M. uintensis* it is still smaller, as 3 : 5. This reduction in *Mesonyx* is, of course, correlated with the loss of the last upper molar, and the proportions in the Uinta species would seem to indicate that the second upper molar was undergoing a similar reduction.

It has been generally assumed that the molar teeth of the *Mesonychidæ* are of

an exceedingly primitive pattern. As far as the upper molars are concerned this is no doubt true, these teeth never varying from a simple tritubercular pattern. *Dissacus*, however, shows that the lower molars were originally of the tuberculo-sectorial pattern, as the postero-internal cusp is distinctly present, from which it follows that the simplicity of the *Mesonyx* molars has been attained by the suppression of parts, somewhat in the same fashion as has been done in the lower sectorial of *Hyænodon* and the *Felidæ*. These lower molars of *Mesonyx* can, however, hardly be called sectorial, as the shearing action is limited by the small height of the outer tubercles of the upper molars. The cusps of the lower series are, therefore, worn upon the summits and very rapidly become blunted and worn down.

A second specimen, consisting of parts of two metatarsals and a phalanx, should probably be referred to this species, as their shape and character are very similar to those of *M. obtusidens*. The latter species is remarkable for the small size and weak development of the feet, but if these bones from the Uinta are correctly referred, *M. uintensis* must have had very different proportions, for they are considerably shorter and much more massive than in the lion. It is obvious that the Uinta *Mesonyx* must have been a very formidable animal, much more so than the more highly organized carnivores and creodonts (except *Hemipsalodon*) which succeeded it in the White River epoch.

Measurements.	*M.*
Diameter of incisor (fore and aft)	.011
" " (transverse)	.011
Diameter of canine	.022
Length second lower premolar	.014
" fourth " "	.028
Thickness " " "	.012
Length lower molar series	.078
" first molar	.031
Thickness first molar	.015
Length second "	.029
Thickness second molar	.015
Length third "	.018
Transverse diameter of mandibular condyle	.037

MIACIS Cope.

This genus of creodonts is the one which most closely approximates the true Carnivora and is characterized by the sectorial $\frac{\text{pm. 4}}{\text{m. 1}}$. This is also true of *Didymictis*, but here the last upper molar is wanting and the lower sectorial is of very different character.

? MIACIS VULPINUS S. & O. (Syn. ? *Amphicyon vulpinum* S. & O., No. 17, p. 255). Since our preliminary account was written we have had the opportunity of examining various specimens of *Amphicyon*, which show that our tentative reference of the Uinta species to that genus must have been incorrect. It is equally clear that the species cannot belong to *Cynodictis*, or to any of the flesh-eaters known to occur in the White River beds, whereas it may very well be a species of *Miacis*, and in view of the similarity of the Uinta fauna to that of the Bridger, this will probably turn out to be the case. The specimen consists of an isolated inferior premolar and first molar.

The premolar, probably the third, consists of a high, acute and compressed cone, with rudimentary posterior heel; a cingulum runs entirely around the crown and is most conspicuous on the anterior surface. The principal cusp is not complicated by the development of accessory tubercles upon it. The sectorial is canine in appearance; the anterior portion consists of three cusps arranged in the ordinary triangle, of which the external is the larger and flattened on the outer side; the anterior cusp is still very low and the sectorial blade is therefore much less completely developed than in *Cynodictis* and hardly more so than in the Bridger species of *Miacis*. The heel of the sectorial is low and small and not very distinctly basin-shaped.

RODENTIA.

PLESIARCTOMYS Bravard.

Of all the rodents of the American Eocene, this genus is by far the most abundant and characteristic, being found in all of the formations above the Puerco, which indeed has hitherto yielded no rodents at all.

This genus has been defined by Cope (No. 3, p. 175-6) as follows: "The crowns of the inferior molars support four rather small and strictly marginal tubercles, which inclose a median valley. The anterior inner tubercle is more elevated than the others, and the posterior two tubercles are connected by a low ridge on the posterior border, which may be more or less tubercular on the last molar. In some of the species the marginal tubercles are merely elevations of the margin, while, in others, the adjacent tubercles of a pair approximate, so as to form a pair of interrupted cross-crests.

"There are five superior molars, of which the anterior is of small size. They resemble those of *Sciurus*, but the transverse crests are obsolete or wanting. The positions corresponding to their external extremities are marked by more or less dis-

tinct cusps. There is a single internal tubercle of the crown. In the third and fourth molars of *P. delicatissimus*, I observe rudiments of a second internal tubercle.

"The incisor teeth are compressed, with narrow anterior face. The enamel is not grooved and is little or not at all inflected on the inner side of the shaft, while it is extensively so on the external face. There is a large round *foramen infraorbitale* like that of *Ischyromys* and *Fiber*, and entirely unlike that of *Gymnoptychus* and *Sciurus*, conforming in this respect to the forms of the extinct group of the *Protomyidæ* of Pomel."

PLESIARCTOMYS SCIUROIDES S. & O. (Pl. XI, Figs. 1–2). The specimen upon which this species is founded consists of a skull, lower jaw and several limb-bones. It differs from the Wasatch and Bridger species principally in the character of the superior molar teeth, in which the transverse crests, wanting in the earlier members of the genus, are clearly though not very prominently developed. There are also several differences of minor importance in the structure of the skull. These characters may possibly be regarded as of generic value, but the changes are so slight and the agreement with the typical species of *Plesiarctomys* so close, that we do not feel justified in forming a new genus. In size the Uinta species is very small, much inferior to *P. delicatissimus*.

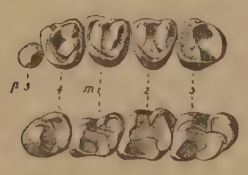
The *skull* is very much like that of the last-named species, but with some not unimportant differences. The muzzle is rather shorter, though both longer and broader than in *Sciurus;* the nasal bones are considerably broader behind than in front, thus reversing the proportions found in *Arctomys;* their anterior ends are somewhat thickened and slightly divergent, and posteriorly they terminate on the same transverse line as the premaxillaries; the latter are quite large and exhibit a considerable surface upon the dorsal side of the skull. The frontals have a broad and nearly straight anterior edge, but narrow very rapidly, showing a very strong postorbital constriction of the cranium and no trace of postorbital processes, as is the very general rule among the more ancient rodents; they also seem to have a smaller anteroposterior extent than in *Sciurus*, though this cannot be definitely decided. This portion of the skull has quite a different aspect from that seen in the two other species, of which the structure of the cranium is known, *P. delicatissimus* and *P. hians*. It differs from the former in that the postorbital constriction is less decided and less elongated from before backwards, while the frontals are much more widely expanded in advance of the constriction and over the orbits; the superciliary ridges seem also to be somewhat more prominent. So far as one can judge from Cope's figure (No. 3, Pl. XXIV, Fig. 5) the postorbital constriction is deeper and the cranium more tapering in front in *P. sciuroides* and *P. hians*.

As in the other species the infraorbital foramen is in the species before us large and situated more immediately beneath the orbit than in *Sciurus*. The shape of the lachrymal cannot very well be made out. The parietals are apparently very long; they are broader than in *Arctomys*, narrower than in *Sciurus*, and the sagittal crest is barely indicated. The squamosal has, of course, a corresponding development; the zygomatic arches are very slender and compressed; they do not arch out very strongly from the sides of the cranium and are somewhat shorter than in *P. delicatissimus*. The anterior part of the arch is shaped much as in *Sciurus*, but the jugal has a somewhat greater vertical depth.

The occiput is very broad and low; in the median line it forms a slight convexity over the vermis of the cerebellum, and on each side of this there is a rather deep depression. The paroccipital processes are very short, and the *foramen magnum* very large. The base of the skull is much injured, but enough is preserved to show that the basi-occipital is rather broad and flat, and that the tympanic bullæ are moderately inflated. The posterior nares are rather long and their anterior edge extends to the front of the last molar; in *Sciurus* and *Arctomys* it is altogether behind the molar series. The mandible is relatively more robust than in *P. delicatissimus;* the masseteric fossa is, however, not so deep, and extends forward to beneath the second molar; the coronoid process is shorter, more slender and pointed, and the notch between it and the condyle is not so deep.

The *brain* is in general like that of *P. hians*, but the cerebellum is proportionately larger, the hemispheres shorter, broader behind and tapering much more rapidly forwards; the olfactory lobes are also narrower.

The *Dentition*. The molar formula of this species, like that of the other members of the genus is pm. $\frac{2}{1}$, m. $\frac{3}{3}$. In the upper series the penultimate premolar (pm. 3) is implanted by a single fang and has a very small and simple crown, thus differing strongly from the large pm. 3 of *Arctomys*. Pm. 4 is nearly as large as the molars. The crown is of triangular shape and consists of three tubercles at the angles of the crown, with a fourth one intercalated between the internal and postero-external cusps, thus forming an interrupted posterior crest; the antero-external cusp is the largest and most prominent of the three. This tooth resembles much the corresponding one of *Arctomys*, but with the difference that the posterior line of tubercles have not coalesced to form a crest and that the cingulum is much less strongly developed on the front of the crown. The molars are very closely like those of *Sciurus*, but of more distinctly triangular shape. In m. 1 and 2 there are two external cusps from which



DIAG. 1.—Upper and lower molars of *P. sciuroides*. × 1.

run two crests, meeting at the internal cusp and thus forming a V. In *Sciurus* the crown is somewhat expanded behind the posterior crest, thus making the inner side of the tooth nearly as broad as the outer; in *P. sciuroides* this expansion is much less marked. M. 3 has but a single transverse crest with a broad basin-like expansion behind it. The upper molars of *Plesiarctomys* are obviously of the same fundamental type as those of *Sciurus* and *Arctomys;* their chief difference from the latter consists in the fact that the cingulum on the anterior side of the crown is not strongly developed and is scarcely visible from the side, whereas in *Arctomys*, this portion of the cingulum is very prominent and gives the side view of the tooth an appearance of being composed of three distinct transverse crests.

The lower teeth are much worn, and it is therefore rather difficult to analyze their construction. The single premolar is composed of a pair of anterior cusps, of which the inner one is high and pointed, the outer one very small and but faintly distinguished from its neighbor, and a low heel. The molars have four cusps surrounding a median depression, of which the antero-internal one is much the most prominent. The presence or absence of connecting crests could not be clearly made out. The resemblance of these teeth to the lower molars of *Sciurus* is very close.

The *humerus* is short and very slender with large head and low, inconspicuous tuberosities; the bicipital groove is distinctly deeper than in *P. delicatissimus*, and the deltoid ridge is quite long and prominent. The distal end of the specimen is broken, but enough remains to show that the epicondylar foramen is present and that the supinator ridge is somewhat less prominent than in the Bridger species so frequently referred. Whether the Uinta species had such a prominent internal epicondyle is not certain.

The *tibia* is quite long, slender, and strongly arched forwards; the distal end is quite deeply grooved for the astragalus and the internal malleolus is well developed. The fibula, although not preserved in the specimen, was evidently entirely distinct, as the outer face of the distal end of the tibia is uninjured and exhibits no trace of coössification with the fibula.

Measurements.	*M.*
Length of skull	.061
Breadth of skull in front of orbits	.025
" " behind "	.010
Length of lower jaw	.028
Length upper molar series	.013
" lower " "	.012
Antero-posterior diameter of lower incisor	.003
Transverse " " "	.002
Length of humerus (estimated)	.043
" of tibia	.066

The chief interest which attaches to *Plesiarctomys* lies in the light which it throws upon the difficult problem of the origin of the rodent dentition. As to this question Schlosser says: "Die Zähne dieser ältesten Formen erinnern einigermassen an das *Omnivoren*-Gebiss. Doch lässt sich die ursprüngliche Beschaffenheit nicht mehr ermitteln. Wahrscheinlich bestand der einzelne Backzahn aus sechs Hügeln ('Denticules'), deren je drei in einer Zahnhälfte vorhanden waren. Der Typus eines solchen *Primitiv-Omnivoren*-Zahnes ist noch am besten in den oberen Molaren von *Dichobune* erhalten. Hier tritt nicht selten noch der sechste Hügel auf, worauf schon Kowalevsky aufmerksam gemacht hat. Bereits zu Anfang der Eocaenzeit erscheint eine grosse Anzahl verschiedener Näger, die indess nur insoferne unter einander verwandt sind, als sie mit Ausnahme von ganz wenigen Arten—*Myomorpha*—als Mittelformen zwischen den in der Jetztwelt ziemlich scharf getrennten *Hystricomorphen* und *Sciumorphen* angesehen werden müssen. Auch fehlen keineswegs Mittelformen zwischen diesen and den *Myomorphen*" (No. 14, pp. 98–99). After a further discussion of the subject Schlosser concludes that the rodents are to be derived from the marsupials.

Plesiarctomys lends but little support to these views, and this genus is entitled to special consideration as being one of the oldest if not the very oldest known form of rodent. Here the superior molars are plainly of the tritubercular pattern, forming distinct crests only in the later species. The inferior molars show the anterior triangle of three cusps with a talon behind, or what Cope has termed the tuberculo-sectorial molar. This is the type of dentition which is all but universal in the Puerco fauna, ungulates, creodonts and lemuroids all exhibit it, and *Plesiarctomys* seems to show that the rodents are to be derived from the same generalized group of primitive placental mammals, the Bunotheria, to which we refer the origin of the types just mentioned. It is, to say the least, very suggestive that the most ancient known types of rodents should exhibit the tritubercular plan of molar structure so unmistably, though it must be admitted that this of itself is not conclusive against their derivation from the marsupials. It removes, however, the necessity of such a derivation, and the other reasons assigned by Schlosser for his view do not appear to be very cogent.

Plesiarctomys is, on the whole, to be regarded as a member of the Sciumorpha, but certain features, such as the large infraorbital foramen and the absence of postorbital processes, are points of resemblance to the Hystricomorpha. This association of characters, as is shown in the passage already quoted from Schlosser, is very generally found to occur in the Eocene rodents.

ARTIODACTYLA.

LEPTOTRAGULUS S. & O.

Our preliminary account of this genus was founded upon the mandible and inferior dentition. Since then a considerable amount of new material has been brought to light in the collection which materially modifies some of our conclusions. The genus may be thus defined: Selenodont artiodactyls with probably unreduced dentition; lower premolars simple and trenchant; molars with short crowns; the crescents of the lower molars are more or less trihedral, and the internal ones not flattened into thin laminæ. The ulna and radius closely applied, but not coalesced; the number of functional digits in the manus probably four, in the pes two.

LEPTOTRAGULUS PROAVUS S. & O. (Pl. VII, Figs. 9–16). This species, the only one as yet certainly indicated from the Uinta deposits, is represented in the collection by several specimens, including the mandible, inferior molar series and last premolar, some fragments of vertebræ and portions of the humerus, ulna and radius, metacarpus, phalanges, scapula, tibia, tarsus and metatarsus. Imperfect as these remains are, they suffice to show the principal characters and systematic position of the genus with sufficient clearness. Unfortunately no part of the skull or of the upper teeth has as yet been identified.

The *Mandible.* Only the horizontal ramus is preserved in any of the specimens; this is elongated, compressed and slender, becoming especially thin beneath the anterior premolars, and thus offering a strong contrast to the short deep mandible of *Protoreodon* with its abrupt chin. The symphysis extends back nearly as far as the front of the second premolar; two minute venous foramina are placed, one above the other, beneath the third premolar.

Dentition. The fragmentary state of the specimens prevents the determination of several important points with reference to the lower teeth of this genus. Thus, the number and character of the incisors and canines are altogether uncertain, though probably they were present in full. In front of the third premolar is a short diastema, and in advance of this occurs a pair of obliquely placed alveoli, which may have contained the first premolar, or the canine and lateral incisor, which latter view seems the more probable on account of the procumbency indicated, though this would necessitate an exceedingly short symphysis. In this case, the number of lower premolars would be but three. The premolars are very simple and trenchant, and in general appearance quite like those of *Tragulus.* Pm. 2 has a very compressed and sharply trenchant crown; it has a sharper posterior edge than in *Tragulus* and is apparently not divided, as in that genus, by a cleft. Of pm. 3 only the fangs are left. Pm. 4 is slightly

more complicated than its predecessors; it consists of a high, acute, and compressed cone with a small and sharp antero-internal tubercle; from the inner side of the apex of the principal cusp there runs downwards and backwards a thin ridge, which encloses a very narrow valley between itself and the outer posterior edge of the crown. The corresponding tooth in *Tragulus* has quite a different appearance.

The molars are very brachyodont and are rather short in the antero-posterior direction; the inner cusps are conical and thick, not flattened out into thin plates; the outer crescents are somewhat trihedral in section and rather angular than curved. The valleys are widely open at the top, but rapidly narrow below, becoming mere slits after a moderate degree of attrition. The two valleys of the same tooth are not quite connected, being separated by the deep constriction between the two outer crescents and by the coalescence of the posterior turn of the anterior crescent with the inner wall of the tooth. They are, however, closely adjacent and even in an advanced stage of wear do not become widely separated. The cingulum is quite strongly marked upon the anterior and posterior faces of the crown, as well as between the outer crescents, where it forms a distinct accessory column, which is largest on the first molar. The heel of the last molar is relatively large and encloses a broad valley; a narrow cleft appears upon its inner wall.

The teeth associated with the skeletal fragments about to be described are so much damaged that their reference to this genus is not quite certain, though very probable; they are somewhat larger than those of the type specimen, and may, perhaps, represent a second species.

Vertebræ. An isolated atlas is probably to be referred to this genus. It just reverses the proportions of the atlas of *Protoreodon* in being long and narrow, and with but slightly extended transverse processes; between the anterior and posterior articular surfaces the body of the vertebra is deeply constricted. The anterior cotylus for the occipital condyle is very deep and transversely extended, narrow from above downwards, and is slightly notched on the outer edge. The transverse processes are thin plates and do not appear to be perforated at the base by the vertebrarterial canal. The surfaces for the centrum of the axis are flat, oval and placed almost transversely; there is no facet upon the posterior edge of the inferior arch of the atlas, for the centrum of the axis beneath the odontoid process, such as occurs in the camels and true ruminants. Fragments of other vertebræ occur in the collection, which undoubtedly belong to *Leptotragulus*, but they are not sufficiently well preserved to warrant description.

Of the *scapula*, the distal portion is preserved. The glenoid cavity is oval in shape, the antero-posterior diameter exceeding the transverse; the coracoid is promi-

nent and but little recurved. The position of the spine is somewhat different from that seen in the recent selenodonts, in which the spine is placed in advance of the median line, thus making the prescapular fossa much smaller than the postscapular. This inequality is also shown in a less degree in *Leptotragulus*, in which respect this genus agrees with the earlier selenodonts, such as *Anoplotherium* and *Oreodon*.

Of the *humerus* we have only the distal end, which, however, shows some interesting characters. The internal epicondyle is not prominent and is pushed to the posterior side; the inner condyle of the trochlea is much extended transversely, while the outer condyle is narrow; the intercondylar ridge is not prominent, and is above rounded and rather broad, but rapidly becomes narrow and sharp. This portion of the humerus forms a strong contrast to that of the oreodonts, which finds a parallel only in *Anoplotherium*. The anconeal fossa is deep and narrow and appears to perforate the shaft.

The *ulna* and *radius* are very closely applied together, but they do not coalesce, at least in the proximal portion, whatever may be true of the distal end. The ulna has a heavy and prominent olecranon and a deeply incised sigmoid notch, with a recurved superior margin. The contact with the humeral condyles is limited to very small inner and outer facets, which are but continuations backwards of the corresponding radial facets. The shaft is quite broad at the level of the head of the radius, but rapidly tapers below this point and becomes very slender and reduced. The head of the radius is both broad and deep; it is only slightly concave, and the division into facets only obscurely marked; the anterior margin rises somewhat towards the inner side; the groove for the intercondylar ridge is very shallow, and the front margin is not notched. Below the head, the shaft tapers and becomes more rounded. Unfortunately neither the distal ends of the forearm bones, nor any of the carpal elements, have been found.

The *femur* is represented by a much damaged proximal end, which, however, presents some interesting features. The head is small, hemispherical, and set upon a long and very distinct neck; the pit for the *ligamentum teres* is but faintly marked. The great trochanter is broken away, but it was obviously large and, with the strongly projecting neck, makes this region of the bone unusually broad. The second trochanter is large, rugose and prominent; what appears to be the remains of a ridge, connects this trochanter with the greater one, as in *Hyopotamus*, to the femur of which this fragment bears considerable resemblance. The shaft is broad and flattened above, but appears to taper rapidly and to become more rounded below.

Of the *tibia* we have only the distal end, with fragments of the proximal condyles, which, however, are too much injured for description. The lower portion of

the shaft is transversely extended and quite massive, expanding but little into the distal end. The articular surfaces for the astragalus are quite deeply incised and separated by a prominent intercondylar ridge. The outer edge of the distal surface shows a narrow facet for the fibula, indicating that the latter had commenced to shift beneath the tibia; though the narrowness of this facet and the large rugose surface upon the external side of the tibia, make it probable that the reduction of the fibula was by no means complete. It has, however, clearly begun.

The foot structure of *Leptotragulus* is very curious, though we are unfortunately not in a position to give a complete account of it. The *manus* seems to have possessed four functional digits, and is represented in the specimen before us by the proximal ends of what appear to be the second and fourth metacarpals. Mc. II (?) is slender, but hardly more reduced than in *Oreodon*. Its proximal end shows three facets, of which the largest is a concave one for the trapezoid, and behind this a separate one for the trapezium; a small oblique surface towards the ulnar side seems to be for the magnum, thus indicating an "unreduced" type of manus. Mc. IV is much stouter and has a trihedral shaft and a simple, saddle-shaped surface for the unciform. On the ulnar side is a deep depression, apparently for the fifth metacarpal. This account is given with reserve, as the fragments described are too imperfect for certain identification, and the differences indicated between the fore and hind foot are very remarkable.

The *pes* is fortunately much better preserved than the manus. The calcaneum is rather long, compressed and deep, with approximately parallel edges. The fibular facet is prominent, strongly arched from before backwards and descending abruptly in front. An astragalar surface is on the inner side of this facet and forms a sharp angle with it. The distal end of the calcaneum is very narrow, but of considerable antero-posterior extent, and bears upon its inner side an unusually large surface for the astragalus. The latter is strikingly high and narrow; the proximal condyles are small and quite widely separated; the outer one is divided by a considerable interval from the cuboidal facet, while the inner extends further down and reaches the navicular surface. The fibular facet upon the outer condyle is very long. The distal trochlea is unevenly divided between the facets for the navicular and cuboid, the latter being very narrow. The inferior surface for the *sustentaculum tali* is long and narrow and separated by a deep pit from the overhanging external proximal condyle. The cuboid is high, narrow, and deep (antero-posteriorly); the calcaneal facet is arched from before backwards and in front descends much below that for the astragalus; it is also slightly broader than the latter; upon the tibial side of the cuboid are two small and widely separated facets for the navicular, the position of which indicates that the

latter bone was comparatively low, and the cuneiforms high. The distal end is entirely occupied by the large facet for metacarpal IV, though what seems to be a small facet for mt. V occurs upon the external side. The posterior hook-like process of the cuboid is long, heavy and recurved.

The metatarsus apparently consists of two functional members, though grooves and facets upon the sides of these indicate the presence of at least the proximal portions of the lateral metatarsals. Mt. II appears to have been less reduced than mt. V. The median pair are more slender than the corresponding metacarpals, and were probably more elongate; their shafts are flattened and the approximate surfaces very closely applied, but show no tendency to coössify; both have strong posterior projections from the proximal ends. The head of mt. III would seem to indicate that the meso and ectocuneiforms were not coössified. Mt. IV covers the entire distal surface of the cuboid, allowing to mt. V only a lateral connection with that bone. The distal ends of the median metatarsals at once suggest the characteristic cannon-bone of the Tylopoda, and are remarkably like those of the White River representative of that group, *Poebrotherium*. The articular surface is but slightly marked off from the shaft, and the keel, though prominent, is confined entirely to the palmar side. When the ends of the two metatarsals are placed together they exhibit a slight divergence, as is the case in a much more marked degree in the recent Tylopoda.

The *phalanges* of the proximal row are long and slender and curved outwards; the proximal surfaces are somewhat symmetrical, causing a slight divergence of the toes. The ungual phalanges are high, compressed and pointed, and somewhat flattened on the internal (approximate) sides; they resemble the unguals of the antelopes much more than those of recent Tylopoda.

The Systematic Position of Leptotragulus.

In our preliminary account, drawn up from the mandibular dentition only, we inclined to the view that this genus was allied to *Prodremotherium*, and was, perhaps, the forerunner of the White River *Leptomeryx*. The new material identified since that description was written, as well as direct comparison with original specimens of *Prodremotherium*, shows that our former conjecture is entirely untenable. The teeth, and still more strongly the skeletal fragments, prove that *Leptotragulus* is very closely allied to *Poebrotherium*, and is, therefore, the earliest known representative of the Tylopoda. If more perfect specimens should confirm the doubtful indication in the type of the loss of the first lower premolar, this species, at least, could not be placed

in the direct line of descent, though in any event it is but slightly removed from that line.

The inferior premolars are composed of the same elements as in *Poebrotherium*, but have quite a different appearance, owing to their moderate antero-posterior extent, while in the latter genus they are very much elongated; the difference between the two being least marked in the case of the last premolar. The most important distinction in the molars of *Leptotragulus* from those of the White River genus consists in their completely brachyodont character; they are also not so far removed from the bunodont pattern; the inner cusps are stout and conical, and the outer distinctly trihedral, while in *Poebrotherium* the crescents, and especially the internal ones, are compressed into thin laminæ. The crescents are not so sharply separated by deep constrictions, and the valleys are more nearly confluent in the Uinta genus; the heel of the last molar is also proportionally larger and contains a deeper valley. Another difference consists in the absence from the molars of *Poebrotherium* of the small columns developed from the cingulum between the outer crescents. The elongated slender shape of the mandible recalls that seen in *Poebrotherium*.

The atlas is almost a reduced copy of that of *Poebrotherium*, but the notch at the side of the anterior cotylus is not nearly so deep, and there is no articular surface developed on the hinder edge of the inferior arch to connect with the centrum of the axis below the odontoid process.

The scapula has a more oval glenoid cavity, a less prominent coracoid, and the spine is placed more nearly in the median line; the intercondylar ridge of the distal end of the humerus is narrower and less prominent.

If we may trust the account given above, the manus is very different in the two genera in that the manus of *Leptotragulus* is but slightly reduced, and that the second metacarpal retains its connection with the magnum. The fibula seems also to be less reduced, though the process has obviously begun. The tarsus, metatarsus and phalanges are much like those of *Poebrotherium*, with only slight differences, such as the larger size of the cuboid hook and the relative narrowness of that bone. The unguals are very closely alike in the two genera, and indicate that the peculiar foot structure which characterizes the camel and llama could not have occurred in the Uinta and White River representatives of the group, which probably had feet with the general appearance of those of the ordinary ruminants. The pad or cushion developed, no doubt, *pari-passu* with the formation of the peculiar cannon-bone with its diverging distal ends. The ungual phalanges of *Protolabis* and *Procamelus* have not as yet been identified, but there is every reason to suppose that they exhibit successive stages of reduction.

Leptotragulus is, therefore, to be regarded either as the direct ancestor of *Poebrotherium*, or as very closely connected with that ancestor. Unless, however, the doubtful indications of tetradactyl feet in the Uinta genus should be confirmed, it throws no great amount of light upon the vexed question of the origin of the camels and their relations to other selenodonts. Among the imperfectly known and sparsely represented artiodactyls of the Bridger, the one which most clearly suggests itself as a forerunner of *Leptotragulus* is *Homacodon*. This animal is described by Marsh (No. 9, p. 364) as being "very nearly allied to *Helohyus*, and but a single step away from this genus towards the selenodonts. * * * This primitive selenodont had forty-four teeth, which formed a nearly continuous series. The molar teeth are very similar to those of *Helohyus*, but the cones on the crowns have become partially triangular in outline, so that when worn the selenodont pattern is clearly recognizable. The first and second upper molars, moreover, have three distinct posterior cusps, and two in front; a peculiar feature, which is seen also in the European genera, *Dichobune* and *Cainotherium*. There were four toes on each foot, and the metapodial bones were distinct. The type species of this genus was about as large as a cat. With *Helohyus* this genus forms a well-marked family, the *Helohyidæ*."

The association of these two genera into a single family is quite inadmissible, as it ignores a fundamental difference in the construction of the upper molars; in *Helohyus* the fifth cusp is in the anterior half of the tooth, while in *Homacodon* it is in the posterior half. This latter genus belongs clearly to the *Dichobunidæ*, and the published description shows no reason for separating it from *Dichobune* itself. Before identifying it with the European form, however, it seems best to wait for fuller information with regard to the American species. Similarly, in the absence of the upper molars, it would be premature to state that *Leptotragulus* is to be derived from *Homacodon*, though there is nothing in what is known of the two genera to forbid such a derivation, which may therefore be fairly assumed. If this connection should be confirmed, it would necessitate revision of the current views upon the relationships of the Tylopoda. Schlosser (No. 13, p. 42) regards this group as a branch of the same general stem which developed the *Anoplotheridæ*, the *Anthracotheridæ*, etc., and especially as being connected with the oreodonts, a suggestion which has also been made by Rütimeyer (No. 11, p. 98). On the other hand, Schlosser derives the tragulines and true ruminants from the *Dichobunidæ*, thus making a very radical distinction between the Tylopoda and the other existing selenodonts. If, however, the suggestion here made, that *Homacodon* and *Leptotragulus* are genetically connected, be confirmed, it follows that the Tylopoda are also to be derived from the *Dichobunidæ*, and therefore from the same origin as the other recent selenodonts. Such a result would

further conclusively demonstrate that the oreodonts are but remotely connected with the camels, as is indeed made exceedingly probable by what we already know of the earlier members of the two groups. *Protoreodon*, which will be fully described hereafter, shows the unpaired cusp in the anterior half of the upper molars, just as in *Helohyus*, from which, indeed, it seems to have been derived, and its resemblance to such types as *Anoplotherium* and the (so-called) Eocene species of *Hyopotamus* is very marked, and Schlosser is fully justified in associating the oreodonts with these phyla. On the other hand, the resemblances between the camels and the oreodonts are only such as are common to all the more primitive selenodonts, and indeed this peculiar family has decidedly more similarity to the tragulines than to the camels. *Leptotragulus* is almost as different from its contemporary *Protoreodon*, as *Oreodon* is from *Poebrotherium*, or *Merychyus* from *Procamelus*. The Bridger representatives of these two phyla are apparently *Helohyus* and *Homacodon*, which not improbably take their rise from a common starting point in *Pantolestes* of the Wasatch, which would thus be the progenitor of the two characteristically American groups of selenodonts, as well as through the *Dichobunidæ* of the European series also. Of course, in the present state of knowledge, these suggestions can only be made tentatively; they are not yet capable of demonstration.

Whether we adopt the scheme of genetic relationships propounded by Schlosser, or the one here suggested, it necessarily follows that the word *selenodont* can only be used as a term of description and not of classification; for it seems clear that this pattern of dentition has been independently assumed by many groups of artiodactyls. Nearly all the types of selenodonts may be traced back step by step to the generalized buno-selenodonts of the Eocene, and the resemblance between the molar teeth of such forms as *Tragulus* and *Cainotherium*, *Oreodon* and *Cervus* is much more probably due to mechanical conditions than to genetic relationship.

Measurements.	*M.* * *Homacodon vagans.*	*M.* † *Leptotragulus proavus.*	*M.* *Poebrotherium wilsoni.*
Length lower premolar series (last three).....		.021	.030
Last lower premolar antero-post. diameter.....		.007	.011
" " " transverse "		.003	
First lower molar antero-post. diameter.....		.008	.011
" " " transverse "		.005	.006
Length lower molar series.....	.017.5	.026†	.042
Last lower molar antero-post. diameter.....	.007.3	.012†	.019
" " " transverse "	.004	.006†	.007
Height of astragalus.....	.014	.020	

* These measurements from Marsh, Am. Jour. Sci. and Arts (3), IV, p. 126.

† Second specimen.

PROTOREODON S. & O. (Pl. VII, Figs. 1–8).

This genus is the most perfectly known and after *Triplopus* the most abundant of all the Uinta mammals. The Princeton collection contains portions of a large number of individuals representing nearly all the important parts of the skeleton and pertaining apparently to two species. The genus is to be defined as follows: "Selenodont Artiodactyla with unreduced dentition; inferior canines with the form and function of incisors, first lower premolar caniniform; superior molars of five crescents, the unpaired one much reduced and situated in the anterior half of the crown, outer wall erect and flattened; crowns very low and broad, valleys widely open; inferior molars much like those of *Agriochœrus* with conical internal crescents. No diastemata in lower dental series and a very short one behind the upper canine. Cranium narrow and very much elongated, orbit open behind, apparently no lachrymal pit. Lunar resting more directly upon the magnum than in *Oreodon;* manus pentadactyl; pes tetradactyl and inadaptively reduced.

Before proceeding to describe the osteology of this remarkable genus it may be well to glance at previous notices of the Uinta selenodonts. The first one described is the *Agriochœrus pumilus* Marsh (No. 8, p. 250), which is founded upon the inferior dentition. It seems highly improbable that this White River genus should occur in the Uinta, and the lower molars of *Protoreodon* being, as we have already seen, much like those of *Agriochœrus*, one is led to infer that this supposed *Agriochœrus* belongs to *Protoreodon*, but in the absence of the upper molars this cannot be certainly determined. Prof. Marsh (No. 9, pp. 364–5) subsequently named three genera from this formation, of which he says: "In the *Diplacodon* horizon of the Upper Eocene, the selenodont dentition is no longer doubtful, as it is seen in most of the *Artiodactyla* yet found in these beds. These animals are all small, and belong to at least three distinct genera. One of these, *Eomeryx*, closely resembles *Homacodon* in most of its skeleton, and has four toes, but its teeth show well-marked crescents and a partial transition to the teeth of *Hyopotamus* from the Eocene of Europe. With this genus is another (*Parameryx*), also closely allied to *Homacodon*, but apparently a straggler from the true line, as it has but three toes behind. The most pronounced selenodont in the Upper Eocene is the *Oromeryx*, which genus appears to be allied to the existing deer family, or *Cervidæ*, and if so is the oldest known representative of the group." "The least specialized, and apparently the oldest, genus of this group [the oreodonts] is *Agriochœrus*, which so nearly resembles the older *Hyopotamus*, and the still more ancient *Eomeryx*, that we can hardly doubt that they all belonged to the same ancestral line." "A most interesting line, that leading to

the camels and llamas, separates from the primitive selenodont line in the Eocene, probably through the genus *Parameryx*." Whether any of these genera includes the previously described *Agriochœrus pumilus*, we are not informed, but the reference to the resemblance between the dentition of *Eomeryx* and that of *Hyopotamus* and *Agriochœrus* may perhaps be taken to imply that the former is founded upon the superior dentition of *A. pumilus*, and may therefore be the same as *Protoreodon*. That *Parameryx* may be identical with *Leptotragulus* is suggested by the reference of the former to the camel line. However, these meagre accounts, with no species descriptions, and no accompanying figures, are insufficient for identification.

The osteology of *Protoreodon* is in most respects very similar to that of its White River successor, *Oreodon*, though in several respects it is more primitive and presents many interesting indications which serve to point out the line of descent through which this remarkable family has passed, as well as its relationships with other groups of selenodonts, both American and European.

The *skull*, which fortunately is in a fairly good state of preservation, presents some features of great interest. It resembles in general construction that of the *Oreodontidæ*, being in some respects like that of *Oreodon*, in others more like the skull of *Agriochœrus*, while, in several ways, it is more primitive than either. As a whole the skull is longer and narrower than in the Miocene forms, a statement which applies especially to the cranium and more particularly to the posterior region of it behind the postglenoid processes, the length of which region is to a remarkable degree greater than in the later genera of the group. The face, on the other hand, is rather short, the anterior edge of the orbit being above the first molar. The cranial and facial axes are in the same straight line, and the upper contour of the skull is also nearly straight, as it is not complicated by the development of large air sinuses in the frontal region. The sagittal crest is very long and prominent, the occiput low and narrow.

As is general among the *Oreodontidæ* the parietals have a very great antero-posterior extent and form with the squamosals almost the entire cranium; posteriorly they are very narrow, but become much broader in front of the squamosals, where they send down great processes to meet the alisphenoids. The high sagittal crest extends the entire length of the parietals. The occiput is rather strongly convex, but is low and narrow, as are also the exoccipitals, which do not extend upon the side walls of the cranium. The paroccipital processes are long and slender, and are much like those in *Agriochœrus*, but are further in advance of the occipital condyles and even more widely separated from the postglenoid processes than in that genus, the elongation of this region of the cranium being especially characteristic of *Pro-*

toreodon. From the crushed condition of this part of the skull it cannot very well be determined whether or not the periotic was exposed upon the surface, but in all probability it was. The frontals form but very little of the roof of the cranium, as they terminate just behind the orbits and are chiefly confined to the covering of the orbits and nasal cavity. The supraciliary ridges are prominent and diverge from the sagittal crest, as in *Oreodon*, terminating in long, overhanging postorbital processes, but, as in *Agriochœrus*, they do not reach the jugal and the orbits are widely open behind.

The squamosals are very large and form most of the side walls of the cranium; they articulate with the parietals both superiorly and anteriorly. The zygomatic processes are very long; the free portion is compressed laterally and quite slender, but the bases have a considerable antero-posterior extent, as in *Oreodon*; the postglenoid processes are less massive, and are less produced transversely and more vertically than in that genus. The glenoid cavity is also somewhat different; Leidy thus describes it in *Oreodon* (No. 7, p. 75): "The glenoid articulation exhibits a broad surface extending outwardly on the under part of the posterior root of the zygoma. Its fore part is nearly straight and horizontal transversely, and is moderately convex antero-posteriorly, inclining forward internally and backward externally. Postero-internally it descends upon a remarkably large and strong postglenoid tubercle, which is antero-posteriorly compressed, mammillary in shape." This description applies also to the glenoid cavity of *Protoreodon*, except that the surface has a smaller extent from before backwards, it is rather more strongly convex in front and is not produced into an elevation internally; the postglenoid process is also much less massive.

In correspondence with the great elongation of the cranium the zygomatic arches are very long; the jugal is long and quite slender and has but a rudimentary postorbital process, which is widely separated from that of the frontal; it is not notched to receive the anterior end of the zygomatic process, as in *Oreodon*, and has a somewhat greater extension upon the face than in that genus. The lachrymal, on the contrary, would seem to be smaller, and apparently had no depression or pit, though this statement cannot be made positively.

The base of the skull is unfortunately much injured and allows but little to be made out with regard to its structure. The alisphenoids are very large and have large pterygoid plates, which bound the much elongated posterior nares; the latter extends far forward between the molars and ends anteriorly in a pointed arch, so that both in shape and position it agrees closely with that of *Agriochœrus*, and is quite different from that of *Oreodon*. It cannot be ascertained, whether or not the tympanic bullæ were inflated, but we may infer that they were from the fact that such

inflation occurs both in *Agriochœrus* and in the oldest species of *Oreodon* which are found in the lowest horizon of the White River formation, the *Titanotherium* beds.

The maxillary resembles that of *Oreodon*, being very low beneath the orbit and extending up to the nasals in advance of the lachrymal; the alveolar portion is low throughout in correspondence with the exceedingly low crowns of the teeth, and even the portion of the maxillary which forms the side wall of the nasal cavity is proportionately lower than in the Miocene genus. The palatine processes are rather narrow, and a narrow incision occurs between the alveolus of the last molar and the palatine plate; this incision is also present in *Oreodon*, but is broader. The infraorbital foramen is situated above the penultimate (pm. 3), which is the position it occupies in *Agriochœrus*, while in *Oreodon* it is placed somewhat more anteriorly. Neither nasals nor premaxillaries are preserved in any of the specimens.

The mandible is short and deep, with an abruptly rounded chin and long, very steeply placed symphysis. The condyle is shaped very much as in *Oreodon*, but the coronoid process is more like that of *Agriochœrus* in being higher and more deeply separated from the condyle, and consequently less like that of the peccary. So far as can be determined the angle of the mandible was not so much thickened as in *Oreodon;* the two rami are not closely interlocked and even in old individuals show no tendency to coössification.

The *dentition* is of especial interest as it serves to connect the isolated and peculiar family of the *Oreodontidæ* with the other selenodonts of the American and European Eocene.

Upper jaw. The superior incisors are not represented in the collection, and only the fang of the superior canine; the latter, however, shows the characteristic D-shaped section seen in *Oreodon*, and doubtless the crown presented no important differences. The same statement applies to the most anterior premolar (pm. 1). The second premolar, seen from the outer side, resembles much the corresponding tooth in *Oreodon*, having a compressed conical crown with trenchant edges. Seen from below, however, it is more simply constructed, as the small internal accessory valleys are barely indicated, and the cingulum is but feebly developed. The third premolar is more transversely extended than the preceding one and has the external wall slightly concave, but is constructed essentially like it, and is consequently simpler than the same tooth in *Oreodon*. Leidy describes these premolars in *Oreodon* as follows (No. 7, p. 81): "The anterior three upper premolars are constructed after the same plan. They decrease successively in size and in the degree of development of their details of form, from the third to the first of the series. Their crown is a trilateral pyramid, with a pointed apex and a broad external cordiform

surface. The narrower internal surfaces appear as triangular inclined planes, separated by a median acute ridge extending from the point to the base of the crown. The anterior of the internal surfaces forms at the base a pair of shallow pouches, defined by a double festoon. The posterior of the same surfaces forms a single and larger pouch at the base of the crown, included by a single and thicker festoon. This latter in the third premolar almost assumes the dignity of an additional lobe to the crown, resembling the internal lobes of the true molars." In *Protoreodon* these festoons are not more distinctly marked on pm. 3 than on pm. 2, being only very faint elevations of the cingulum and single, not double, on the anterior part of the crown. Pms. 3 and 4 are each implanted by three fangs, pms. 1 and 2 by two. The last premolar has the form seen in *Oreodon* and the ruminants generally; it consists of two crescents, an internal and an external and an internal, with a strong internal cingulum. The outer crescent still retains the cordate shape and the trenchant edges seen in the anterior premolars, and is considerably larger than the external crescents of the true molars. The cingulum is not so strongly developed on the outer side, nor is the external wall of the tooth so deeply concave as in *Oreodon*.

The anterior premolars of *Protoreodon*, with their great simplicity of construction, are decidedly more like those of *Agriochœrus* than those of *Oreodon*, but the fourth premolar resembles that of the latter genus, while in *Agriochœrus* it has reached an extraordinary degree of complication, having almost completely assumed the molar pattern, and differing only in the rudimentary state of the postero-internal lobe.

The molars of *Protoreodon* increase in size successively from the first to the third; the crowns are very low and broad in proportion to their antero-posterior extent; the valleys are very shallow and widely open; the internal crescents are massive pyramids, and the horns are very faintly marked ridges. The external crescents are intermediate in character between those of *Oreodon* and of *Agriochœrus*, in being less concave and overhanging and less deeply separated by an outward extension of the median valley than in the latter, more so than in the former, with an additional resemblance to *Oreodon* in the compressed shape of the buttress between the outer lobes and in the faint convex ridge which runs up from the apex of these crescents. The balance of resemblance, as far as the outer wall of the tooth is concerned, inclines therefore towards *Oreodon*, while the construction of the inner half of the crown and the general appearance of the whole is more like that of *Agriochœrus*. A very important difference from the molars of all the oreodonts hitherto known consists in the presence of a fifth lobe situated in the anterior half of the crown; it is but slightly separated from the antero-internal crescent, with which it is apparently

beginning to coalesce. These five-lobed upper molars are found among nearly all the selenodonts of the American and European Eocene, and the discovery of *Protoreodon* confirms Schlosser's conjecture (No. 13, p. 42) that the *Oreodontidæ* have been derived from animals with molars of this pattern, though this ancestral type is clearly not what he supposed it would be, namely, the common form from which both oreodonts and Tylopoda have descended.

Lower jaw. The incisors increase in size from the median to the lateral one; their crowns are proportionately higher than in *Oreodon* and of somewhat different shape, in that they are more flattened and quadrate in outline and the cutting edges are straighter. In the median one the cutting edge is placed nearly at right angles to the lateral edges, while in *Oreodon* the incisors are more acute and pointed. As in all the later members of this family, except *Pithecistes*, the lower canine has assumed the form and functions of an incisor, and forms the largest of that series, while the first premolar has become caniniform, a transformation which is entirely peculiar to this line of selenodonts. Analogous changes occur in *Xiphodontherium*, where pm. 2 is caniniform, and in *Hypisodus* where the canine and first two premolars have gone over to the incisor series, but only the oreodonts show the enlargement of the first premolar and such a change of shape, that it almost deserves the name of a tusk. In *Protoreodon* the caniniform premolar is directed upwards and outwards, scarcely at all forwards; the outer side is quite strongly convex, the inner side is divided by a ridge, running down from the acutely pointed apex, into two somewhat concave surfaces, of which the anterior is somewhat the larger; the anterior and posterior edges of the crown are sharp and trenchant. In *Oreodon* both the outer and inner sides of the crown are more flattened; that is to say, in *Protoreodon* the transformation is less complete, the tooth retaining very clear marks of the fact that the functional canine is in reality a premolar. The other premolars have considerable resemblance to those of *Oreodon*, but are of less complicated construction and are more compressed and trenchant. Pm. 2 is a simple compressed cone, with very small transverse and considerable antero-posterior diameter; on the hinder edge is a very narrow and shallow depression, which is much more marked in *Oreodon*, but not in *Agriochœrus*, where this tooth is entirely simple and reduced in size. Pm. 3 is an enlarged copy of pm. 2, except that the internal cingulum is more pronounced and the posterior valley somewhat larger. In *Oreodon* this tooth is proportionately much larger, the valley is enlarged, curved inwardly and completely enclosed; the anterior half is also much more strongly concave on the inner side. Pm. 4 is more or less broken in all the specimens, but enough remains to show that it was more simply constructed than in *Oreodon*, which Leidy thus describes: "From the median point

an oblique ridge descends internally and terminates in a large trilateral pointed tubercle which springs from the middle of the base of the crown and rises nearly as high as the principal point." In *Protoreodon* this tooth has a very much smaller transverse diameter than in the Miocene genus; the anterior half of the crown is much less concave on the inner side, and it would seem that the internal tubercle was rudimentary and the posterior valley small. At all events, the greater simplicity of the tooth can be seen from the anterior half of the crown, which is uninjured.

The true molars differ in several important respects from those of *Oreodon* and are more like, but not identical with, those of *Agriochœrus*. The inner crescents are more conical and less compressed than in the former genus, and the outer cusps are less distinctly crescent-shaped; they are also more widely separated from the inner crescents, so that the valleys are much broader and shallower. The anterior pair of crescents is much more completely separated from the posterior than in *Oreodon*, by a depression which runs across the crown. All this is equivalent to saying that in *Protoreodon* the selenodont pattern of the lower molars is much less completely developed than in *Oreodon*. Compared with the molars of *Agriochœrus*, those of the Uinta genus present the following differences: The internal crescents are convex on the inner side, instead of being concave with a median ridge, and the basal tubercles on these crescents are smaller; the outer crescents are less flattened and the bones slightly more prominent, though leaving the valleys open in front. As in this genus, the heel of the last molar is proportionately larger than in *Oreodon*.

The *brain of Protoreodon* (Pl. III, Fig. 1″), as indicated by the shape and size of the brain case, is very narrow and considerably elongated; the hemispheres are especially small and more simply convoluted than in *Oreodon;* the convolutions are, as in this genus, rather broad and have a nearly straight fore and aft direction, converging in front; the medilateral gyrus is not very distinctly marked. The posterior region of the brain including the cerebellum and medulla is very long in proportion to the hemispheres, and apparently the *corpora quadrigemina* were partially uncovered by the interspace separating the hemispheres from the cerebellum. As a whole, the brain is distinctly smaller in proportion than in the Miocene genera of the group.

The *vertebral column* is represented in the collection by many specimens from all the regions; but as they are not in an especially good state of preservation, and as they do not show any very striking differences from the vertebræ of *Oreodon*, they will not require an extended description.

The atlas is very similar to that of *Oreodon* and resembles therefore that of the tragulines rather than that of the Pecora; it is short in the antero-posterior direction,

but with widely extended transverse processes, which are perforated by the vertebrarterial canal. The anterior cotylus for the occipital condyles is quite shallow, the posterior faces for the axis are quite flat and with greater vertical than transverse diameter. The axis is likewise similar to that of *Oreodon*, though with differences. The atlanteal faces are narrower than in that genus, but higher, and form a considerable part of the side walls of the neural canal; the odontoid process is narrower and more peg-shaped, and the articular surface on its lower side is not continuous with the facets for the atlas, but separated by a faint ridge; the upper surface of the process is marked by a quite high and strong ridge, which loses itself posteriorly in the floor of the neural canal. In *Oreodon* the upper surface of the odontoid is either flat or, as is the case in many specimens, it shows an approximation to the spout-like form of the ruminants in the elevation of the edges, so that it becomes somewhat concave from side to side. The shape of the process is thus seen to be quite different in *Protoreodon*. The centrum of the axis is keeled and quite strongly opisthocœlus; neither neural spine nor transverse process is preserved in any of the specimens.

The other cervical vertebræ are rather longer in proportion than those of *Oreodon* and have somewhat more markedly opisthocœlous centra; the anterior ones at least have either obsolete or very low spines, and apparently all except the seventh exhibit the vertebrarterial canal.

Except for their light and slender construction, neither the dorsal nor the lumbar vertebræ present any special peculiarities; the posterior dorsals are long and compressed, the lumbars become broad and depressed in the hinder part of the region. The artiodactyl characteristic of cylindrical and interlocking zygapophyses in the posterior dorsal and lumbar vertebræ is quite as well developed as in the White River genera of the group. Several caudal vertebræ indicate that the animal possessed an unusually long and stout tail, even more so than in *Oreodon*, as is made probable by the size of the transverse process upon the more anterior vertebræ.

Of the *scapula* only the distal portion is preserved, which is, however, sufficient to show its more essential characters. The glenoid cavity is subcircular in outline, much as in *Oreodon* and Hyopotamus; the coracoid process is recurved and prominent, and the spine rises abruptly from the neck, as in *Oreodon* and the ruminants, and having a very different shape from that which occurs in the pigs. As far as can be judged from the fractured condition of the specimens, the spine may be said to divide the blade into nearly equal pre- and postscapular fossæ. This position of the spine is rendered the more probable from the fact that it occurs in *Oreodon* and *Hyopotamus*, with the scapula of which the portions of the shoulder blade of *Protoreodon* which are preserved in the collection closely agree.

The *humerus* agrees closely with that of *Oreodon*, which, as Cope has pointed out (No. 4, p. 508), is very peculiar and differing from that of all recent artiodactyls, finds its nearest analogue in *Anoplotherium*. "The greater tuberosity is large, rising above the head; and is incurved, terminating inwards in an acuminate apex. Its border at the base is thrown into an obtuse angle. The lesser tuberosity is small, and is well separated from the greater by a deep and wide bicipital groove. The deltoid ridge is distinct. The condylar extremity is more transversely extended than in any recent artiodactyl, owing to the fact that the posterior internal distal tuberosity is placed interior to the trochlea instead of partially behind it, and that there is, in addition, an internal epicondyle not seen in the recent suilline or ruminant members of the order. The intercondylar ridge is strong, and wider than in most recent ruminants; in the suillines it has nothing like such a development. Another peculiarity is the flange-like free border of the external trochlea, which is especially recurved at its superior part." With a few modifications this description will apply equally well to the humerus of *Protoreodon*. The shaft is rather more slender and the deltoid ridge much less massive and prominent; the anconeal fossa is narrow and very deep, perforating the shaft, as is also generally the case in the Miocene genus.

The *ulna*, as would naturally be expected, shows no tendency to coössify with the radius; the olecranon is unusually long and stout and deeply grooved at its upper end; the sigmoid notch forms somewhat less than a semicircle and passes below into two small facets for the head of the radius. The shaft is stout and trihedral in the upper portion, but becomes very much compressed below and presents a deep groove on the internal side. The distal end is not preserved in any of the specimens. This bone shows more differences from the corresponding element of *Oreodon* than does the humerus; the most important of these are the proportionately greater size of the olecranon and the singular flattening and grooving of the shaft.

The *radius* differs but slightly from that of *Oreodon*, as far as the fragments preserved allow of comparison. The surface for articulation with the humerus is a rather broad head, which is much compressed from before backwards; the articular facets form three portions, a median concavity for the intercondylar ridge, or tuberosity it might be called, and a more flattened surface on each side of this. The external beveled surface for the curious flange on the humeral condyle above mentioned, is more concave and descends lower on the anterior face of the bone than in *Oreodon*, and the anterior edge is somewhat more sinuous than in that genus, though there is no emargination for the intercondylar ridge, such as occurs in the anterior proximal edge of the radius in the recent ruminants, and, in a much less marked degree, in the suillines. This structure of the head of the radius is highly charac-

teristic of the *Oreodontidæ* and is correlated with the equally characteristic shape of the trochlea of the humerus. The ulnar facet on the posterior side of the head of the radius is much less conspicuous than in *Oreodon*. The shaft has a somewhat flattened, transversely oval shape, which does not tend to become cylindrical, as is the case in *Oreodon*. Unfortunately we have not been able to identify the distal end of the radius.

The *carpus*. As one would naturally expect, the structure of the carpus of *Protoreodon* is very much like that of the Miocene members of the family, though some variations of importance may be observed, especially that the various elements are less cuboidal in outline and of lighter construction.

The scaphoid is more extended transversely and less antero-posteriorly than in *Oreodon;* the proximal surface is more deeply concave, the rising in front more abrupt and the radial facet descends further on the anterior side; on the distal surface the facet for the trapezium is distinctly larger than in the Miocene type, where it is exceedingly minute; the trapezoid facet is also larger in proportion, while that for the magnum is correspondingly smaller, nor are there any such anterior ridge and posterior concavity as are to be seen in the later representatives of the family. In *Oreodon* the lunar, as Cope has pointed out, has the remarkable peculiarity of resting almost entirely upon the unciform, while the magnum has moved almost completely under the scaphoid, a tendency which reaches its maximum in *Merycochœrus* and *Merychyus*, when there is only a lateral contact between the lunar and the magnum. Among recent artiodactyls, the only group where such a displacement of the carpal elements is to be found is that of the Tragulina.

In *Protoreodon* the same peculiar construction of the carpus appears, but it has not been carried to quite the same extent. The lunar has a greater antero-posterior diameter, the radial surface is more extended in the same direction and is not nearly so strongly convex. The distal beak-shaped prolongation, which passes between the magnum and the unciform, has not moved quite so far toward the radial side, and even in front the lunar rests somewhat, though but slightly, upon the magnum, while, behind, the magnum is proportionately much larger and presents more directly downwards, instead of being rather more lateral than distal, as is found to be the case in *Oreodon*. The unciform facet of the lunar is of course smaller than in the last-named form. The Uinta genus thus presents a transitional stage between the carpus of the more typical artiodactyls and that characteristic of the *Oreodontidæ*, though the tendency towards the latter is already very distinct.

The cuneiform differs more from the corresponding bone in *Oreodon* than does any of the other carpal elements. Indeed, the specimen which we have regarded as

the cuneiform of *Protoreodon* may possibly belong to some other genus, though this is not at all probable from the association in which it was found. It is much more extended transversely and less antero-posteriorly than in *Oreodon*, as is also the scaphoid; the ulnar facet is a simple groove which does not descend upon the outer side of the bone, thus agreeing with *Oreodon* and differing very markedly from *Dicotyles;* the pisiform facet is very large, nearly flat, and occupies the entire posterior surface; the unciform facet is likewise quite different from that of *Oreodon* in being shallow, of less antero-posterior and greater transverse extent. In general the cuneiform of *Protoreodon* is quite low and broad, with an *f*-shaped upper contour, highest on the internal or radial side and sloping down towards the external side. Neither trapezium nor trapezoid is represented in any of the specimens, but judging from the facets on the scaphoid, both of these bones were better developed than in *Oreodon*, implying a larger relative size of the lateral digits.

The magnum, on the contrary, is smaller and of a somewhat different shape; the proximal surface is divided nearly evenly between the facets for the scaphoid and lunar which meet at a high angle so as to form a sharp ridge along the superior median line. Seen from the side the upper contour of the magnum forms a flattened arch, whereas in *Oreodon* the magnum is quite low in front and rises abruptly behind, and nearly the whole of the proximal surface is taken up by the facet for the scaphoid. Another difference consists in the long hook-like process which in *Protoreodon* is given off from the posterior surface of the bone, and which in *Oreodon* is represented by a mere rudiment. When the bone is in its natural position the distal surface for mc. III presents obliquely downwards and outwards, even more obliquely than in *Oreodon*. As usual in unreduced artiodactyls there is a small facet on the radial side of the magnum for mc. II.

The unciform likewise presents some important differences from that of *Oreodon*. In this genus the lunar and cuneiform facets are of very nearly equal size, while in *Protoreodon* the latter considerably exceeds the former, as naturally follows from the already-mentioned fact that the lunar rests less completely on the unciform than in *Oreodon*. The surface for the attachment of the cuneiform is less distinctly convex and extends more closely to the external side of the bone than in the Miocene forms. On the distal surface the facet for mc. IV is smaller and that for mc. V larger than in *Oreodon*, and the latter is more distal in position and less crowded to the external side by the increased development of mc. IV than in *Oreodon*. This difference brings about a further one in the shape of the inferior contour, which is more regularly curved from side to side and not so distinctly angulated in *Protoreodon*. The lateral facet for mc. III is of about the same proportions.

The *metacarpals* are but scantily represented in the collection, and only one of these exhibits the proximal end. Fortunately, however, this is the first metacarpal or pollex, the existence of which would naturally be inferred from its presence in *Oreodon*. There can no longer be any question as to the pentadactyl character of the fore foot in *Oreodon*, as two specimens of *O. Culbertsoni*, Colorado and Dakota, with the pollex in position, are preserved in the Princeton Museum, and in the Museum of Comparative Zoology there is a beautifully preserved manus of *O. gracilis* in which all five digits lie in their natural position in the matrix. In *Protoreodon* the first metacarpal is proportionately better developed, being both stouter and longer, than in *Oreodon*. Its proximal end has a nearly flat head for articulation with the trapezium. In none of the specimens of *Oreodon* mentioned have any phalanges been found in connection with mc. I, though the distal end is rounded and faintly keeled on the palmar side, indicating the probable existence of phalanges. Such were certainly present in *Protoreodon*, as is shown by a small proximal phalanx belonging to the pollex. Its proximal facet is very oblique, sloping strongly outwards, and is but slightly concave. Its distal surface plainly shows the articulation for the ungual. The pollex, though of small size, was thus present in all its parts, and the importance of this fact as connecting the artiodactyls with the always pentadactyl Condylarthra is obvious. It seems almost certain that artiodactyls with unreduced anterior feet existed through the Bridger and Wasatch periods, though it is somewhat surprising to find them persisting so late as the White River Miocene.

The *pelvis* is not well preserved in any of the specimens. Several fragments seem to show that in construction it is essentially like that of *Oreodon*, and therefore rather suilline in character. The ilium has a long compressed peduncle which expands rather abruptly into a large terminal plate for articulation with the sacrum. There is no supra-acetabular fossa. The length of the ischium could not be ascertained.

The *femur* would seem to be longer and stouter proportionately than in *Oreodon*. The rotular trochlea is very prominent and quite narrow, and has the inner edge higher than the outer. A difference from *Oreodon* is shown in the presence of a fossa for the plantaris muscle instead of a rugose surface, though, as Kowalevsky has shown, no great importance can be attached to this character.

The *tibia* is only imperfectly represented; some points may, however, be made out with regard to it. It is entirely unankylosed with any portion of the fibula, and has a stout shaft of transversely oval section below, above it is more trihedral. The distal end is very like that of *Oreodon*, with deeply incised grooves for the astragalus and a very well-developed malleolar process.

The *fibula* is entire but very slender. Its distal end is closely applied to the

astragalus, forming a large external malleolus, and as in all artiodactyls rests upon the fibular facet of the calcaneum.

The *hind foot* is very closely similar to that of *Oreodon*, even more so than is the fore foot. The astragalus is somewhat narrower in proportion to its height and the difference between the external and internal condyles in size is somewhat more marked. The internal condyle passes directly into the navicular facet, though interrupted by a slight prominence. The distal end is very unequally divided between the navicular and cuboidal facets, the former being much the larger; the difference is perhaps even more marked than in *Oreodon*. These two genera agree thus with *Anoplotherium* and the Suina and differ from most ruminants in which the two facets are of more nearly equal extent. The calcaneal facets and those for the malleolar processes of the tibia and fibula resemble the corresponding parts in *Oreodon*, except that the distal calcaneal surface is larger. The calcaneum is much more slender than in *Oreodon* and is especially less expanded at the distal end. The fibular facet rises to a greater height and distally is more abruptly marked, and the interval between this facet and the distal end is considerably greater than in *Oreodon*. The sustentaculum projects further internally, though decidedly small, as in all oreodonts. The cuboidal facet is more arched and concave from before backwards, and narrower from side to side, while the distal astragalar surface is flatter and larger. In fact, the calcaneum differs from that of *Oreodon* more than does any other tarsal bone.

The cuboid is higher and narrower than in *Oreodon* and the astragalar and calcaneal facets more equal, though the latter is somewhat broader. In correspondence with the greater length of this part of the calcaneum, the cuboid is much more deeply incised by the calcaneal facet, and the anterior edge of the navicular surface rises high above it. The distal surface of the cuboid displays the usual facets for the fourth and fifth metatarsals; the latter is larger and the former is smaller than in *Oreodon* and of somewhat different shape. Another difference from this genus consists in the greater extension of the hook-like projection from the rear of the cuboid. In fact the differences are so striking as to raise the suspicion that the specimen described belonged to some other genus, as unfortunately it was not associated with teeth. But from its correspondence with the calcaneum it very probably should be referred to *Protoreodon*, and its differences from the cuboid of ruminants and pigs are even more marked than from *Oreodon*.

The navicular is likewise higher and narrower than that of *Oreodon*, but otherwise resembles it very closely; its proximal surface is somewhat more deeply concave and its anterior edge rather more sinuous. Cope's statements (No. 4, p. 510) with regard to the cuneiforms of *Oreodon*, are in some respects inaccurate, and

require correction before we proceed to the comparison with *Protoreodon*. Cope's description is as follows: "The ectocuneiform is distinct, and much wider than long. The mesocuneiform is extero-posterior in position, and the transverse diameters are small. It is produced distally overlapping the head of the second metatarsus. Entocuneiform wanting." In reality the ecto- and mesocuneiforms are coössified, the line of junction between them being marked by a slight step, or difference of level on the distal surface, which indicates the two facets for the second and third metatarsals respectively, and what Prof. Cope has called the mesocuneiform is really the entocuneiform. If Prof. Cope's statements were correct, *Oreodon* would present the remarkable anomaly of having the ectocuneiform support two digits, while the mesocuneiform supports none at all, or in other words, having the second metatarsal shifted outwards from its ordinary attachment. Besides this, the ectocuneiform persists with remarkable constancy in the ungulate series, and its absence in such an unreduced pes as that of *Oreodon* would be very extraordinary. But as we have seen, these anomalies do not exist. In *Protoreodon* almost exactly the same conditions are found as in the Miocene genus, only here the difference in height between the meso- and ectocuneiforms and consequently the distal step is more pronounced. The entocuneiform is not preserved in any of the specimens, but the facets on the navicular and second metatarsal show that it was shaped very much as in *Oreodon*.

The *metatarsals* are four in number and entirely free; no trace of the hallux has been found, and in all probability none existed. The metatarsals are of more equal development than in *Oreodon*, the lateral ones being somewhat larger in proportion to the median, as would be inferred from the structure of the distal row of tarsals; in other respects they are closely alike. The second metatarsal has a somewhat lateral bearing on the ectocuneiform, and metatarsals III and IV are closely interlocking. The ridge on the distal end of the metapodials is confined to the palmar surface.

The *phalanges* also resemble those of *Oreodon*, those of the first row being long and depressed, those of the second row shorter and with the distal trochlea even less asymmetrical than that of *Oreodon*, showing a less degree of convergence of the hoofs than in that genus, and hence very much less than in any of the recent artiodactyls except the Tylopoda. The ungual phalanges are, as would be inferred from this, but slightly asymmetrical; they are higher, narrower, more pointed, and altogether more claw-like than in the Miocene members of the group, with the exception perhaps of *Merychyus*.

The only clearly characterized species of *Protoreodon* is *P. parvus* S. & O., of which the type specimens are the skull and lower jaws figured on Pl. I, Figs. 1 and 2. This was a very small animal, inferior in size even to *Oreodon gracilis*. The

measurements agree fairly well with those of the so-called *Agriochœrus pumilus* Marsh, with which this species may prove to be identical.

Measurements.	*M.*
Length upper molar series (entire)	? .053
" " premolar series	? .026
" " true molar "	.027
Length lower molar series (entire)	.054
" " premolar series	.027
" " true molar "	.027
Third upper molar, antero-posterior diameter	.010
" " " transverse "	.008
" lower " antero-posterior "	.012
" " " transverse "	.006

Although the teeth preserved in the Princeton collection all belong to *P. parvus*, there are several limb and foot bones which exceed those of the type species so greatly in size, that they very probably belong to a larger species. They differ, however, only in size and must unquestionably be referred to the same genus. Size alone is not a very satisfactory criterion, but it seems unlikely that such differences can be within the limits of mere sexual or individual variation. The following measurements will show the size of these larger specimens of *Protoreodon* as compared with that of *Oreodon Culbertsoni.*

Measurements.

	Protoreodon.	*O. Culbertsoni.*
	M.	*M.*
Breadth of humeral trochlea	.016	.021
Height " " "	.011	.013
Length of calcaneum	.050	.052

Systematic Position and Relationships of Protoreodon.

It will be obvious from the foregoing description that *Protoreodon* is very closely allied to the White River genus *Oreodon*, and may safely be regarded as the ancestor of that genus. This relationship is made clear by a comparison of the skull, the teeth and the feet, where the differences which *Protoreodon* exhibits from its Miocene successor are just these tendencies towards the simplification that we should naturally expect to find in the ancestral type. More particularly the presence of the fifth cusp in the upper molars is a welcome indication of the connection between the oreodonts and the buno-selenodonts of the earlier Eocene. On the other hand, *Protoreodon* has many points of resemblance to *Agriochœrus*, which are somewhat as follows: (1) The shape of the cranium and the remarkable elongation of its posterior portion; (2) the

open orbit and probable absence of the lachrymal depression; (3) the position and shape of the posterior nares; (4) the position of the infraorbital foramen; (5) the character of the anterior premolars; (6) the character of the lower molars and of the internal part of the upper. These differences of importance separate *Agriochœrus* from *Protoreodon*, namely, that in the former there are considerable diastemata in both upper and lower jaws, that the last premolar has assumed more or less completely the pattern of the molars, and that the outer crescents of the upper molars are overhanging.

Can *Protoreodon* then be regarded as the common ancestor of both sections of the Miocene family, the *Oreodontinæ* and the *Agriochœrinæ?* As to the derivation of the former subfamily from this genus there seems to be no reasonable doubt; its relations to the second are more obscure. If we accept Schlosser's view that a closed dental series is always secondary, and a sign "dass der betreffende Stamm am Endziel seiner Entwicklung angelangt ist, wenigstens finden wir diesen Zustand, nur bei solchen Formenreihen, welche gerade im Aussterben begriffen sind" (No. 13, p. 46), it is clear that *Agriochœrus*, with its diastemata, cannot be derived from *Protoreodon*. But even if this principle be generally true, it is not without exceptions, as the long persistence of the oreodonts themselves demonstrates, and the diastemata are, therefore, of themselves insufficient to decide the question. A more important difficulty is the constitution of the outer crescents of the upper molars, which in the known species of *Protoreodon* have commenced to assume the flattened shape characteristic of *Oreodon*. The Uinta genus therefore stands very near to the common ancestor of *Oreodon* and *Agriochœrus*, but seems itself not to be that ancestor, at least so far as we may judge from the teeth of *P. parvus;* it is quite possible that another species of the same genus may stand in the same relation to *Agriochœrus*.

The forerunner in the Bridger fauna of *Protoreodon* would seem to be *Helohyus* Marsh, known as yet only from the teeth. In this genus the upper molars have five cusps, the unpaired one in the anterior half of the tooth, which are of a pyramidal shape, and refer the genus to the generalized group of buno-selenodonts, which is represented by the Eocene hyopotamids of Europe. If more perfect specimens shall confirm this supposed connection between *Helohyus* and *Protoreodon*, it will demonstrate the connection of the *Oreodontidæ* with the *Anthracotheridæ*, which has been already often surmised. With regard to the connection of the former group with the Tylopoda, we have seen in considering *Leptotragulus* that the relationship is probably a very remote one, and that the Tylopoda seem to pass backwards into the *Dichobunidæ*, from which Schlosser derives the typical ruminants and the Tragulina.

In his later papers (No. 5, p. 384) Prof. Cope has included *Protoreodon* among

the *Xiphodontidæ* on account of the presence of the fifth cusp in the anterior half of the upper molars. This arrangement is, however, quite untenable, as this unpaired cusp is common to the great majority of the selenodonts and even the bunodonts of the Eocene. On the other hand, the peculiar structure of the premolars in *Xiphodon*, the caniniform premolar of *Protoreodon*, and the entirely divergent structure of the feet in the two genera, show that their relationship to each other can only be a remote one, and that any association of them in a single family must be arbitrary. This is especially the case when we consider the obviously close relationship between the *Oreodontidæ* and *Protoreodon*, which is recognized in Cope's scheme (*l. c.*, p. 387). If the presence of the fifth cusp be looked upon as a family character, then it will be necessary to form a new family, the *Protoreodontidæ*, for the reception of this genus. But this seems to be unnecessary, and a more natural method would be to regard the Uinta type as forming a subfamily of the *Oreodontidæ*, characterized by the five-lobed upper molars, and in other respects combining the features of the Miocene subfamilies, the *Oreodontinæ* and the *Agriochœrinæ*. This last fact is of particular importance, as it proves the connection between *Agriochœrus* and the true oreodonts, and shows that Cope's reference (*l. c.*, p. 388) of this genus to the *Dichodontidæ*, on account of the complication of the last premolars, does not represent the natural arrangement. Whether we adopt Leidy's view, that *Agriochœrus* is the type of a distinct family, or with Gill regard it as representing a subfamily of the *Oreodontidæ*, is a matter of comparatively little importance; the essential fact being the close genetic connection of the two.

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Part III.

BY HENRY FAIRFIELD OSBORN.

THE PERISSODACTYLA.

It is necessary to open this section with some observations upon the synonymy of the Eocene Perissodactyla. With the assistance of Prof. Marsh, the writer recently examined the types in the Yale College collection, in comparison with those at Princeton. The result shows that the entire nomenclature of these genera is in utter confusion, arising from the attempts which have been made by others to work from the brief descriptions given by Prof. Marsh and without the aid of figures. This confusion extends through all the American and foreign literature which relates to the American Eocene fauna, and invalidates a great deal of otherwise very useful work.

The synonymy of *Helaletes* (Marsh) is *Dilophodon* (Scott) and *Desmatotherium* (Scott). *Lophiodon nanus* (Marsh) also belongs to this genus. *H. latidens* (nobis) must be separated from it. It was originally distinguished from *Hyrachyus* by the presence of a third lobe on the last lower molar; this lobe is very small and forms the only distinction between the type and the mandibular dentition of *Dilophodon minusculus*. The maxillary dentition is precisely like that of *Hyrachyus*, except in point of size and in the presence of two internal lobes upon the third and fourth premolars. The latter feature was given by us as the generic distinction of *Desmatotherium*. The dental structure (excepting only the rudimental third lobe) and the tarsal characters remove it entirely from the tapir series, and relate it to *Triplopus*, from which, however, it is probably generically distinct. *Colonoceras* has precisely the dentition of *Hyrachyus agrarius* Leidy. The rudimental horn cores upon the nasals may serve as a generic distinction, although, in the very limited knowledge we have of the nasals of *Hyrachyus*, this character is not altogether satisfactory. *Limnohyus* is a *nomen nudum*, having been applied to a type already preoccupied by *Palæosyops*. Prof. Marsh will apply a new generic name to his *L. laticeps*.

The primitive horses are in much confusion. *Eohippus** (Marsh) is a synonym

* Am. Jour. Sci. and Arts, Nov., 1876, p. 401.

of *Hyracotherium* (Owen). *Orotherium** (= *Lophiotherium*) was based upon a good type lower jaw; it has the last lower premolar like the molars; it is identical with and precedes *Orohippus*,† which was founded upon an uncharacteristic type (*O. pumilus*, a number of loose upper molars), and was not fully defined until later upon the discovery of *O. agilis*. Both genera are, however, synonymous with *Pliolophus* Owen, which is defined by the last premolar being like the molars. The species, *O. agilis*, is however founded upon a type in which the third and fourth upper premolars have two internal lobes; it thus falls within the definition of *Epihippus*.‡ *Epihippus* is thus in turn close to *Anchilophus*, but may be distinguished from it by the more depressed crests and less complete union of the para- and metaconules into transverse crests. Then follows *Mesohippus* with three premolars like the molars, and crests like those of *Anchilophus*.

There is a remarkable parallelism in the assumption of the molar pattern by the premolars in all the perissodactyl series. We can almost predicate of any Wasatch genus, fourth premolar unlike the molars; of any Bridger genus, fourth premolar like the molars; of any Uinta genus, third and fourth premolars like the molars; of any White River genus, second to fourth premolars like the molars.

PERISSODACTYLA.

AMYNODON.

Numerous errors have found their way into the descriptions of the skull and dentition of this genus which require correction before its affinities can be discussed. There are now three skulls known which may be referred to three species. First, the type *Amynodon advenus* Marsh, from the Uinta beds; second, the type of *A.* (*Orthocynodon*) *antiquus*, nobis, from the Washakie beds; third, the type of *A. intermedius*, spec. nov., from the Uinta.

Prof. Marsh's description of the type is as follows:§ "The skull is intermediate in form between that of a tapir and a rhinoceros, but the molar teeth are entirely of the latter type. The premolars are all unlike the molars, and the canines above and below are very large. The incisors are small and the inner one in each jaw is lost in the present adult animal. The lower canines are placed nearly horizontal, and, taken in connection with the rest of the anterior dentition, they prove conclusively that the large lower teeth usually regarded as incisors in *Aceratherium* * * * are really canines." The number of digits is stated to be 4–3. This description is erroneous

* Am. Jour. Sci. and Arts, Sept., 1872, p. 217.

† *Op. cit.*, proposed Sept., 1872; defined May, 1873.

‡ Introd. and Succession of Vert., etc., Aug., 1877, p. 28.

§ Am. Jour. Sci. and Arts, Third Ser., Vol. XIV, p. 251.

in most of the particulars, partly owing to the fact that it was drawn up before the type specimen had been removed from the matrix and put together, and in this way, even after examining the type ourselves, as Prof. Marsh kindly allowed us to do, we were formerly led to consider the Bridger species as a distinct genus (*Orthocynodon*).

A second examination of the type specimen recently made brings out several important diagnostic characters in addition to those already noted in our preliminary bulletin, p. 262. There are three lower and probably three upper incisors; the first lower premolar is wanting. The canines are erect. There are rugose postorbital, antorbital and infraorbital processes. The nasals are very short and slightly overhang the anterior nares. The type of *A. antiquus* is still found to resemble that of *A. advenus* closely, with the important exception that there are four lower premolars instead of three, the first lower premolar being fully functional and bifanged; the first upper premolar is missing. It may subsequently be found to represent a distinct genus as we at first supposed, for which the original name *Orthocynodon* would stand. The *A. intermedius*, besides its much larger size, may be clearly distinguished from the two foregoing by the procumbent position of the canines and by the retention of a single fanged first upper premolar.

These and other characteristics throw a new light upon the phylogenetic position of the *Amynodontidæ*, which will be discussed later.

AMYNODONTIDÆ S. & O.*

Rhinoceros-like animals extending from the Middle Eocene to Lower Miocene; skull deeply excavated in front of orbit; incisor border very broad; nasals short and hornless; canines and incisors present and functional in both jaws; pattern of the molars like that of the rhinoceros except for the non-reduction of the external crest of the third upper molar; probably four toes in front and three behind; probably astragalus rests upon the cuboid as in the rhinoceros.

This definition is considerably modified from that previously given by the writers, in order to embrace the Miocene genus.

The genera embraced in this family are:

Lower Miocene (*White River*).

METAMYNODON,† nobis. Dentition, i. $\frac{?3}{3}$, c. $\frac{1}{1}$, pm. $\frac{3}{2}$, m. $\frac{3}{3}$. Upper and lower canines obliquely placed, the latter fitting somewhat internal to the former when the

* E. M. Museum Bulletin, No. 3, 1883, p. 4.

† Bulletin of the Museum of Comparative Zoölogy, Sept., 1887, p. 165.

jaw is closed. The second, third and fourth upper premolars of the molar pattern. Postglenoid and posttympanic processes widely united. Periotic not exposed.

Upper Eocene (Uinta).

AMYNODON* Marsh. Dentition, i. $\frac{?3}{3}$, c. $\frac{1}{1}$, pm. $\frac{4-3}{4-3}$, m. $\frac{3}{3}$. Upper and lower canines erect or obliquely placed. The third and fourth premolars of the molar pattern. Postglenoid and posttympanic processes separated. Digits: 4–3 (Marsh).

A. ADVENUS Marsh. Premolars $\frac{3}{3}$. Number of upper incisors uncertain. Upper canines obliquely placed, lower canines erect.

A. INTERMEDIUS, spec. nov. Premolars $\frac{4}{?}$; first upper premolar rudimentary and single fanged. Canines in both jaws very large, semi-procumbent, oval in section. Three functional upper incisors.

Middle Eocene (Washakie).

A. (ORTHOCYNODON) ANTIQUUS, nobis. Premolars $\frac{?4}{4}$; first upper premolar bifanged. Canines in both jaws vertical, triangular in section. Number of upper and lower incisors uncertain. Mastoid portion of periotic exposed.

AMYNODON INTERMEDIUS.

PLATE X.

This species is represented by the base of the anterior portion of a skull (No. 10,309) in beautiful preservation, showing the complete characters of the teeth, the palate, the position of the orbit and the lower portion of the premaxillaries. The four canines and an upper molar of another individual are preserved. Part of the lower jaw and a premolar of a third, and the mandibular symphysis of a fourth. There are also numerous skeletal fragments, which however cannot be referred to *Amynodon* with any certainty.

Dentition (Figs. 10, 10*a*). The three incisors are equidistant; the median one is slightly larger than the lateral and is placed about as far from the premaxillary suture as the lateral incisor is from the canine. The crowns are pointed, convex on the anterior and posterior faces, and slightly compressed laterally. The canines are very powerful, with lance-shaped crowns and a decidedly flattened oval, quite unlike the trihedral crowns in *A. antiquus;* they project forward at angle of forty-five degrees, and slightly outwards; the fangs are powerful and deeply rooted beneath the first premolar. There is a considerable diastema.

* Am. Jour. Sci. and Arts, Sept., 1877, p. 251.

The first premolar is represented merely by the fang, which is rudimentary on one side. The second premolar has a slight swelling on the outer face which anticipates the postero-external lobe; there is a single prominent internal cusp united by two low subequal ridges with the external crest; surrounding the inner lobe is the prominent cingulum which also characterizes all the succeeding molars. The third and fourth premolars are interesting as showing a mode of development of the posterior crests quite unlike that in the tapir or Equus series; there is as yet no reduplication of the internal lobe as in the latter series, but the posterior crest grows directly out from the bilobate external crest in the valley formed by the prominent cingulum and the much broader and more elevated anterior crest; these two teeth are practically similar and submolariform, except that the third premolar has a less distinct posterior lobe and crest.

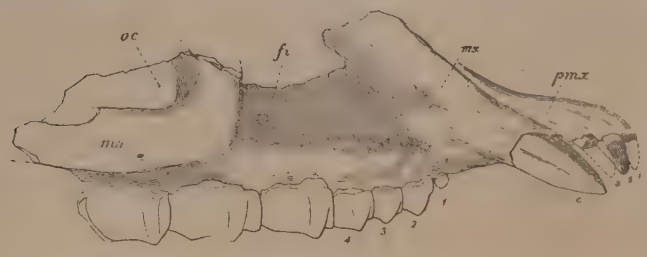
The first true molar is very similar to that in *Aceratherium;* the anterior crest has a slightly marked "anticrochet" which is entirely wanting in m.^{2} and m.^{3}; the external crest is perfectly flat and decidedly inclined inwards. The second molar has the same characters with a very decided extension of the external crest beyond the posterior transverse crest. In the third molar the external crest arches out widely beyond the posterior crest; the base of the crown is subquadrate in outline.

Measurements.

	A. antiquus.	*A. intermedius.*	*Metamynodon planifrons.*
	M.	*M.*	*M.*
Antero-posterior diameter of median lower incisor.....	.011	(upper do.) .012	
Fore and aft diameter of crown of lower canine at base.	.015	(upper do.) .031	.035
Upper jaw.			
Fore and aft diameter of third premolar.....	.019	.021	
Length of entire molar series.....		.187	.225
" " true molar.....	.104		.160
Fore and aft diameter first molar.....	.037	.044	.047
Transverse " " "	.037	.043	.068
Fore and aft diameter, second molar.....	.045	.053	
Transverse " " "	.037	.052	
Fore and aft diameter, third molar.....	.028	.046	.060
Transverse " " "	.030	.046	.064
Measurement of canines, outside		.115	.130

The *skull.* The most striking features of the skull are at once seen to be the great breadth of the maxillaries opposite the canines and their deep excavation between the canines and the antorbital ridge; the snout is thus broader than the

anterior premolar region. The anterior nares were apparently widely open. The premaxillaries are rather narrow above and spread inferiorly, rounding and arching forwards into the broad incisive border; the relations of these bones in *Metamynodon* indicate that they had a deep area of union in front, contrasting strongly with the separate slender premaxillæ of *Aceratherium*. The malar projects widely below the orbit which is immediately above the second molar and the maxillaries are deeply depressed and incurved in front of the antorbital ridge.



DIAG. 2.—*Amynodon intermedius*. Side view of the anterior portion of the skull. × ¼.

The upper and posterior regions of the skull are entirely wanting in this specimen, and have been fully described in the E. M. Museum Bulletin upon the skull of *A.* (*Orthocynodon*) *antiquus*.

The Relations of the Amynodontidæ.

The Washakie species, both in structure and time, is the most primitive form, as indicated by the complete dentition and the perfectly erect position of the canines. Then follows the *A. advenus* from the Uinta with small erect canines and the reduction of one premolar, otherwise very similar in size and dentition to the foregoing. The *A. intermedius*, while retaining the rudiments of the first premolar, which were probably lost in fully adult specimens, shows a very decided transition towards *Metamynodon* in the enlargement, shape and procumbent position of the canines, also in the broadening of the snout and compression of the antorbital region. It is singular to note how little progress the premolars of *Metamynodon* show; the second premolar is like the third, but in none are the posterior crests very prominent.

Phylogenetic Position of Amynodon.

The discovery of *Amynodon*, with its full complement of teeth and markedly rhinocerotic molar pattern, naturally led Prof. Marsh to suppose he had found the long-sought Eocene representative of the true rhinoceroses.* This opinion has been adopted by every one. But the discovery of *Metamynodon*, which is certainly far from the rhinoceros line and is an undoubted successor to these Eocene forms, directs attention to a number of developmental features which suggest an entirely distinct supposi-

*Introduction and Succession of Vertebrate Life in America, p. 30.

tion, viz., that this is another line of pseudo-rhinoceroses parallel to the *Hyracodontidæ*. For while the molar dentition and perhaps also the lower canines point directly to *Aceratherium*, the development of the other teeth and many characters of the skull are very diverse. Prof. Cope* presents a third alternative in deriving *Hyracodon* from *Amynodon*, placing these genera in one family, and not placing the latter in the *Aceratherium* (*Cœnopus*) series at all.

The features which unite the known *Amynodontidæ* with the aceratherine line are: (1) The structure of the lower molars and of the superior molars to the second molar inclusive; (2) the structure of the astragalus, in extending upon the cuboid. The distinguishing features of the *Amynodontidæ* are: (1) The retention of fully functional incisors in both jaws, and the great enlargement of the canines; (2) the retention of the lophiodont character of the last upper molar in its subquadrate form and complete external crest; (3) the retarded development of the posterior crests of the superior premolars; (4) the deep excavation of the maxillaries in front of the orbit and flattening of the cranium, together with the shortening of the nasals.

In *Aceratherium*, on the other hand, from the lowest American Miocene, we find the upper canines entirely wanting, also one of the incisors; the premaxillaries are narrow and weak, and support two subequal incisors. In the lower jaw are the large lateral teeth and small median pair, of very doubtful homology. Upon the discovery of *Amynodon*, Prof. Marsh suggested that the outermost lower tooth of *Aceratherium* was a canine, instead of an incisor as previously supposed, but there is little additional basis for this opinion. *A. occidentale* has, moreover, long nasals and convex maxillaries. In fact, excepting in the molar series we find no support for the supposition that *Aceratherium* is a descendant of any known species of *Amynodon*. The resemblance of *Hyracodon* to *Hyrachyus*, of *Mesohippus* to *Hyracotherium*, of *Titanotherium* to *Palæosyops* is altogether of a different character, and in each case is relatively far more significant of direct descent.

So far as Prof. Cope's suggestion of the descent of *Hyracodon* from *Amynodon* is concerned, the following objections may be made: (1) The dentition and osteology of *Hyrachyus* fill in every respect the conditions which we should expect to find in an ancestral form of *Hyracodon*, both in the displacement and reduction of the foot bones and characters of the teeth; (2) a wide difference between the aceratherine and hyracodon series is found in the structure of the carpus and tarsus. The position of the *Amynodontidæ* it appears turns upon these parts. An astragalus found near the skull of *A. antiquus* (see Diag. 12) resembles closely that of *Aceratherium* in its broad cuboidal facet. If, in addition, as we think highly probable, *Amynodon*

* The Perissodactyla. Am. Nat., 1887, p. 999.

is found to possess four toes in the manus, the series can be readily placed intermediate between *Hyracodon* and the rhinoceroses; (3) these genera have in common a complete incisor series, but in contrast with *Amynodon*, *Hyracodon* shows a decided degeneration of the canines; (4) the molars of *Hyracodon*, while imitating those of the rhinoceros, entirely lack the peculiar proportions and inclinations of the external and transverse crests, which are so distinctly rhinocerotic in *Amynodon*.

The difficulties which have been indicated in any attempt to derive the rhinoceros from any known species of *Amynodon* do not preclude this derivation from some member of the *Amynodontidæ;* the point insisted upon here is, that such a member has not yet been discovered; secondly, that the later *Amynodontidæ* represent a distinct line of pseudo-rhinoceroses, probably intermediate between the true line and the *Hyracodon* series. They approach the true rhinoceros in part of their tooth structure and probably in the foot structure, and the latter series in the remainder of the dental structure.

DIPLACODON Marsh.

As observed by Marsh at the time this genus was established,* *Diplacodon* is intermediate between the Bridger genus *Palæosyops* and the Lower Miocene *Titanotheriidæ*. Nothing is known of the skull, the type consisting merely of the palate and complete maxillary dental series. Unlike the Bridger genera the fourth premolar is like the molars and the second and third premolars are developing the second internal cusp, and in process of assuming the molar pattern. We may anticipate that the skull will show the initial development of the great horns of *Titanotherium*. The numerous remains of the skeleton in the Princeton collection enable us to fully confirm the relationship suggested by Marsh. The skeleton is in every detail intermediate between that of *Palæosyops* and *Titanotherium*, and presents a remarkable intermingling of characters persisting from its smaller Bridger progenitors and anticipating its great Miocene successor. Allowing for a moderate elongation of the dorsal spines, *Diplacodon* stood about five feet seven inches at the shoulder, while *Palæosyops* stood a little less than four feet, and *Titanotherium* considerably over seven feet. The metapodials retained the stilted spreading character seen in *Palæosyops;* much longer than in this genus and less bulky than in *Titanotherium*. On the other hand the cervical vertebræ in some species are much flattened, indicating a short neck similar to that in the Miocene genus. The detailed comparative measurements given below are taken from a *Palæosyops* species of the middle size, probably *P. paludosus;* the measurements of *Diplacodon* are mostly from a skeleton belonging to a

* Am. Jour. Sci. and Arts, March, 1875, p. 246.

single individual; the *Titanotherium* measurements are approximate from specimens which we have referred to *T. proutii.*

It is remarkable that the comparatively small genus *Palæosyops* anticipates in so many features the gigantic Miocene genus. The foot structure in almost every detail is persistent, this being the only line of Perissodactyla known in which there is no reduction of the fifth digit. Then we find in *Palæosyops*, as shown in the diagrams, every tarsal articular facet reproduced in the later genus. The neck, in some species at least,* undergoes considerable change in proportion, but the dorsal spines of the Eocene genus are decidedly elongate and anticipate the great hump of *Titanotherium.* The skull undergoes an entire remodeling, consisting principally in the elevation of the occiput, this being correlated with the elongation of the dorsal vertebral spines and development of a powerful *ligamentum nuchæ* to support the nasal horns. The earlier species of *Titanotherium*, *T.* (Megaceratops) *coloradense*, for example, retain the long nasals overhanging the premaxillaries which are so characteristic of *Palæosyops.* A feature common to the three genera is the prominence of the lesser trochanter.

In addition to the features already mentioned as distinguishing the Miocene and Uinta genera from their Eocene ally, we notice the prominent and recurved deltoid hook of the humerus; the eversion of the major axes of the innominate bones, with the marked expansion of the suprailiac border. In the manus and pes, while the facets remain the same, the proportions of the different elements are much altered, as pointed out in a later section. In the pelvis and tarsus, however, as already stated, *Diplacodon* stands nearer the older than the more recent form.

In the Washakie beds is found a large species, about the same size as *P. validens* Cope, which is provisionally referred to *Palæosyops* (*P. hyognathus*, spec. nov., Princeton collection, No. 10,273). This is represented by a lower jaw seven-eighths as large as the type mandible of *Diplacodon.* As in the latter, the incisors form a close procumbent series; the tips forming a gently arched line when seen from above. The symphysis is extremely long (11 cm.) and shallow; the canines are rather small and semi-procumbent. The molar-premolar series measures 24.5 cm., the last molar measures 6.5 cm., the transverse measurement outside of the canines is 9.6 cm.; in *Diplacodon elatus* the same measurement is 10 cm. Unfortunately the premolar crowns are broken; it is probable that one or two of the premolars will be found to be like the molars. The characters of the chin and symphysis are significant of close relationship to *Diplacodon elatus.*

* In Prof. Marsh's collection there are some cervical vertebræ referred to *Diplacodon* which have about the same proportional length as in *Palæosyops.*

It is not possible to determine the species to which our skeletal remains of *Diplacodon* belong, as we have but a portion of a single upper molar. They may be referred to *D. elatus*. *Palæosyops* has hitherto been referred to the *Chalicotheriidæ*, but the discovery of the foot bones of *Chalicotherium* by Filhol shows that the genera are widely separated. The discovery of the skeleton of *Diplacodon*, however, links *Palæosyops* very closely to *Titanotherium*, and the differences between these three genera are principally in three characters, viz., the assumption of the molar pattern by the premolars, the development of frontal horns, and the loss of the incisor teeth. If these characters are given a family rank we cannot decide where to place *Diplacodon*. It seems best to group the three genera in the single family *Titanotheriidæ*.*

Diplacodon elatus.

Generic characters. Dentition, fourth and third upper premolars like the molars. Last upper molar with single internal cone. Digits 4–3.

Specific characters. Second upper premolar with a rudimentary postero-internal cusp, like the molars.

As above stated, the specific reference of these specimens is uncertain. The cervical vertebræ are much shorter than those associated with the Yale College specimens. It is probable that they represent a distinct species.

The Skeleton.

Plate VIII.

Cervicals. The *axis* (No. 10,396*a*), Fig. 15, has a broad spine overhanging the postzygapophysis. The laminæ are very slightly notched. The postzygapophyses are an elongate oval. The transverse processes are hooked, turning inwards at the tip and perforated at the base. The centrum presents a sharp inferior keel. The remaining cervicals and dorsals belong to a single individual (No. 10,396). The cervicals preserved are probably the 3d, 4th, 5th and 6th. The 5th is the most complete (Fig. 1); the spine is pointed, vertically placed and grooved posteriorly; the zygapophyses are very stout with the facets placed at angles of 45°; the vertical diameter of the centra is much greater than the transverse; they are quite strongly opisthocœlous; the transverse processes do not extend below the level of the centrum.

The centra of seven dorsals are preserved. The one figured is between the

* This generic and family name has been adopted by the writer because *Menodus* Pomel is found to be preoccupied by *Menodon* v. Meyer, and *Titanotherium* Leidy must supersede it.

7th and 10th (Fig. 2). The centrum is opisthocœlous and considerably excavated at the sides; the antero-posterior and transverse diameters are about the same; the lower half of the spine is preserved, it is a stout triangle in section indicating a great length and strongly oblique inclination; the zygapophyses are almost horizontal. One of the lumbar centra preserved is considerably longer than the above-described dorsal, and has a stout keel; the spine is broad (Fig. 4) and grooved posteriorly; the zygapophyses are rounded and vertically placed.

These vertebral characters closely repeat those observed in *Palæosyops*, except that the cervical centra, while nearly double in height and breadth, are only a trifle longer. In *Titanotherium* the cervicals are not further shortened, but retain the proportions seen in *Diplacodon;* they are, if anything, somewhat longer. The dorsal spines are still more elongate, forming a great hump which was incipient in *Palæosyops* and probably well developed in *Diplacodon.*

Two *ribs* are preserved which belong respectively in the anterior and middle region of the chest. They are much lighter and more rounded than in *Titanotherium.* The complete rib from the midregion has a subquadrate section in the upper third of the shaft, and an oval section in the lower third; it does not show the extreme flattened oval seen in *Titanotherium;* the length, not allowing for curvature, is 71 cm., showing that the depth of the chest was about thirty inches.

PLATE IX.

Scapula (Fig. 12). Both scapulæ are preserved, but the superior and lateral borders are incomplete. The coracoid process is a stout tuberosity. The glenoid fossa is an elongate and rather shallow oval. The spine ascends very gradually from the neck and passes without an acromial process into a deep recurved ridge; in a midsection the spine is much expanded along the border and overhangs the postscapular fossa. The parts preserved indicate that the scapula was lofty, with a rounded suprascapular border unlike the somewhat angular border of *Titanotherium* and without any distinct indentations such as are seen in *Rhinoceros.*

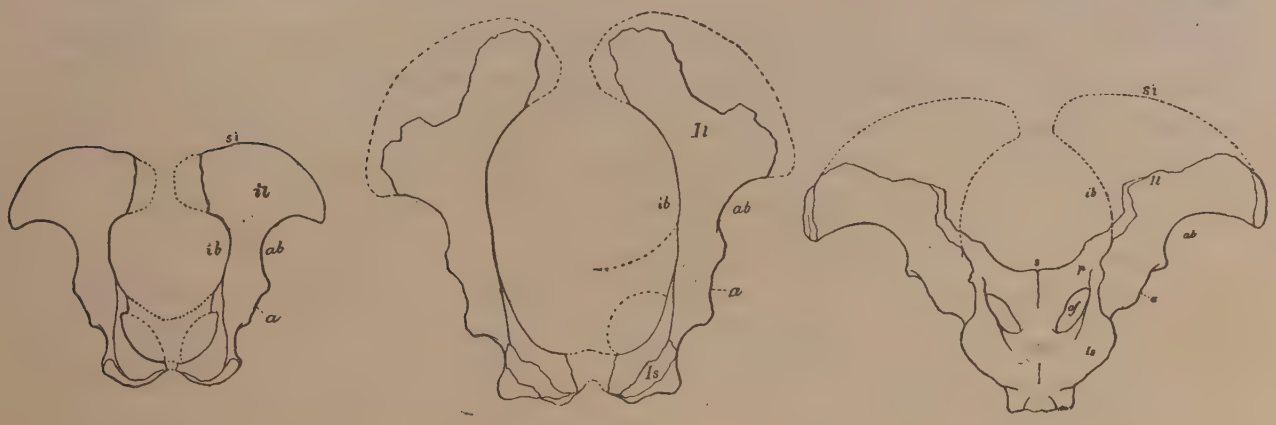
Humerus (Figs. 11 and 11*a*). The humerus lacks the head, lesser tuberosity and bicipital groove. There is a stout deltoid ridge terminating in a prominent recurved hook. The shaft is twisted upon itself as in Rhinoceros, that is the major diameter passes obliquely from the outer posterior to the inner anterior side. The supinator ridge is less distinctly marked than in *Rhinoceros* and less prominent than in *Titanotherium.* The pronator ridge is also rugose but not projecting. The supratrochlear fossa is deeply excavated and the trochlear surfaces are somewhat oblique to the main axis of the shaft.

Ulna and *radius* (Fig. 13). These bones are complete, and taken together indicate a rather long and slender forearm. The proximal portion of the radius covers the entire ulna, and the shaft crosses to the ental side. The relative diameters of the distal facets are about as five to two. The ulna has a very stout rugose olecranon; the posterior border presents a single concave curvature to the distal extremity; the midsection of the shaft is triangular with a deep groove upon the anterior face. The radius in midsection of the shaft is suboval anteriorly and flattened posteriorly; the facet for the ental condyle of the humerus has the same transverse, but much deeper antero-posterior diameter than that for the ectal.

The *Manus*. The carpus is entirely wanting. The metacarpus and a few of the phalanges are preserved. They show a high stilted tetradactyl metapodium of the "digitigrade" type, that is, with the phalanges resting entirely upon the ground. The distinctive feature of the foot is seen in the subequal size of the second and fifth digits, which brings the working median axis between the third and fourth digits instead of through the middle of the third. The carpus was thus undoubtedly of the type intermediate between *Palæosyops* and *Titanotherium* as restored in outline. The second metacarpal has proximally (Fig. 13*b*) a pear-shaped facet for the trapezoid, a magnum facet extending to its full depth; it also overlaps mc. III. The third metacarpal has a subquadrate magnum facet and triangular unciform facet, overlapping mc. IV by separate anterior and posterior facets. The fourth metacarpal has a corresponding mc. III facet; the unciform facet is fractured posteriorly. The fractured proximal portion of mc. V shows a narrow concave unciform facet and a lateral facet for mc. IV. The keels are entirely confined to the posterior surface, as shown in a distal view of mc. II (Fig. 13*a*). The measurements are as follows: Length, mc. III—18 cm., mc. V—13 cm. Depth of proximal facets, mc. III—3.5 cm., mc. III—3.3 cm. Breadth of distal facets, mc. III—4 cm, mc. V—3.4 cm., mc. II—3.4 cm.

The *pelvis* (No. 10,393). The marked characteristics of the pelvis are the great length of the *ossa-innominata* as compared with their breadth. The accompanying restoration of the pelvis, as viewed from above, shows the parts which are preserved in *Diplacodon* in comparison with the pelves of *Titanotherium* and *Palæosyops*. The ilia do not expand immediately above the acetabula as in the Miocene genus, but there is a long and rather slender neck as in *Palæosyops*, beyond which they expand. The acetabular border presents a short sharp curvature, and is relatively much shorter than in *Palæosyops;* the ischial border (*ib.*) is much longer, with a gradual curvature. It follows that the suprailiac border apparently presented outwards more than directly upwards and forwards as in *Palæosyops* and *Titanotherium*—a result of the

unequal growth of the acetabular and ischial borders. The acetabular rim is much fractured; from its upper border a ridge (the pubic border) extends beneath the ilium, parallel with the ischial border to the sacral surface. Below the acetabulum the ischium has a triangular section; it then expands in a plane directly perpendicular to that of the ilium. There are no remains of the pubes.



Diag. 3. Diag. 4. Diag. 5.

Posterior view of the pelvis of (3) *Palæosyops* × $\frac{1}{12}$, of (4) *Diplacodon* × $\frac{1}{12}$, of (5) *Titanotherium* × $\frac{1}{18}$. *Il*, ilium; *Is*, ischium; *P*, pubis; *si*, *ib*, *ab*, borders of the ilium; *a*, acetabulum; *of*, obturator foramen.

The *femur*. This bone is represented by the somewhat crushed shaft (No. 10,395), and a well-preserved distal half apparently belonging to individuals of the same size, both belonging to the left side; they are combined in Fig. 5. The head and great trochanter of the former specimen are wanting. The lesser trochanter is represented by the base of a stout ridge, which indicates that it was much more prominent than in *Rhinoceros*. The third trochanter, judging by the base, was still more prominent and strongly curved forwards. It stood higher upon the shaft than in *Rhinoceros*. The lower portion of the shaft with the facets are very similar to those of the Rhinoceros, except that the patellar trochlea is longer and more deeply excavated; the condylar facets have a greater fore and aft extension, and the intercondylar notch is deeper.

Another specimen in which the head and great trochanter are preserved shows that the head was well out of the line of the shaft, with a deep pit for the round ligament. The great trochanter stands upon the level of the head.

The *tibia* (No. 10,395) is about five-sevenths the length of the femur (Fig. 6). The cnemial crest is moderately prominent. There is the usual triangular section of the shaft just below the crest passing into an oval section in the lower third. The prox-

imal and distal faces are too much worn to admit of description. Another specimen (Fig. 6*a*) shows a prominent internal malleolus and strong spine.

The *tarsus* (Figs. 8–8*b*). The well-preserved astragalus and calcaneum are of great interest. Their relations to those of *Palæosyops* and *Titanotherium* are fully discussed in the next section. The principal features of the calcaneum are the extremely narrow, deep and elongate tuber calcis, which has an unusually flattened section; there is also a distinct fibular facet, and the calcaneum also forms part of the tibial trochlea. The three astragalar facets, the ectal, sustentacular and inferior, are entirely distinct. The astragalus rests upon over one-third of the upper surface of the cuboid. These elements of the ankle joint indicate that *Diplacodon* was of much less bulky proportions than *Titanotherium*.

Comparative Measurements of the Skeleton, in Cm.

	Palæosyops.	*Diplacodon.*	*Titanotherium.*
(?) Fifth cervical vertebra, antero-posterior	3.2	4	6.5
" " " transverse	4.2	6.7	9
(?) Ninth dorsal vertebra, antero-posterior	3.7	6.5	6.5
" " " transverse	4.7	5.7	10
Lumbar vertebra, antero-posterior	4.7a	6	7
" " transverse	39a	6.2	10
Total length of scapula, estimated	27	60e	72a
Length of humerus	30.5	45e	67.2a
" " radius	25	35	65a
" " third metacarpal	11	18	24a
Width of carpus	6.7	10	
Depth " "	4	8e	11.2a
Total length of innominate bone	41	61	78a
Length of femur	33.5	46e	
" " tibia	27.5	33	
Width of tarsus	6.5	8.5	14.5a

a = approximate measurement. e = estimated.

The *Palæosyops* measurements are taken from the middle size species (*P. paludosus*), which predominates in the Western Bridger basin, and while taken from different individuals are probably very nearly correct in proportion. The *Diplacodon* measurements, with the exception of the femur, tibia and tarsus, are also from portions collected together and belonging to one individual. The *Titanotherium* vertebral measurements are from a single individual, but the other parts are taken from a number of individuals. The *P. major* of the Bridger is fully one-fourth larger than the above species.

ISECTOLOPHUS S. & O.

Isectolophus is a small tapiroid, slightly larger but with shorter limbs and feet and more spreading digits than the Uinta *Triplopus*.

In the line of genera to which it belongs the characters of the premolars in respect to the gradual assumption of the molar pattern are very important. These are wanting in the Uinta specimens, but the Bridger species, which was formerly referred by us* to *Helaletes* (*H. latidens*) is closely related to *Isectolophus*, if not generically the same, and shows double internal lobes upon both pm. ^{3} and pm. ^{4}. The second upper premolar probably had two external lobes and one internal lobe. The distinctive features of the dentition, so far as known, are seen in the conic postero-external lobe of the upper molars, in the third lobe of the last lower molar and the absence of a diastema in the lower jaw. As pointed out in our preliminary description, these features place *Isectolophus* in or near the true tapir line. This conclusion is sustained by the discovery of the complete carpus and of the cuboid. The carpus is of a more primitive type than that of *Triplopus*, since the magnum and cuneiform surfaces of the lunar are subequal, as in *Hyrachyus*, while in *Triplopus* the magnum surface is much reduced, leading to the *Hyracodon* type. A still more important feature is the size of mc. v, as shown by its articular facet upon the cuneiform, indicating that there were four functional toes. The cuboid, when compared with that of *Triplopus*, is broad and reduced in vertical diameter.

Generic characters. Dentition, c. $\frac{1}{1}$, p. $\frac{4}{4}$, m. $\frac{3}{3}$. No diastema behind the canine. Fourth and probably third premolars in both jaws submolariform or with double internal lobes. Molars in both jaws resembling those of *Tapirus*. External lobes of superior molars (paracone and metacone) strongly convex and equal in size. Last lower molar with prominent third lobe. Manus and pes. Digits, 4-? 3. Lunar with subequal magnum and unciform facets. Cuboid broad with an extensive astragalar facet.

Isectolophus annectens,† nobis. The postero-external lobes of the superior molars are produced beyond the junction of the posterior transverse crests. A strong cingulum surrounds the crown.

I. (*Helaletes*) *latidens*,‡ nobis. The postero-external lobes are opposite the junction of the posterior crests. There is no cingulum.

The Bridger species may subsequently be found to represent another genus, but in the absence of the complete dentition of *Isectolophus*, it can only be separated by the characters of the molar crests, which are hardly generic. The structure of the premolars removes this genus from *Systemodon* Cope.

* E. M. Museum Bulletin, No. 1, 1878, p. 54.

† Proc. Am. Phil. Soc., Sept. 2, 1887, p. 260.

‡ E. M. Museum Bulletin, No. 1, 1878, p. 54.

Isectolophus annectens.

Plate X.

This genus is represented in the Princeton collection by portions of four individuals, which apparently belong to the same species, and by the type of a second species from the Bridger. The type specimen (No. 10,400) consists of the second premolar and first and second molars of the maxillary series and the last lower molar and portions of the last premolar and first molar of the mandibular series. The second specimen (No. 10,401) preserves the first upper molar and fragments of the premolars and the fourth lower premolar associated with a portion of the ramus; also a complete carpus and portions of the metacarpus; also the cuboid and metatarsal elements, in addition to the vertebral and limb fragments. The third specimen (No. 10,399) is a mandibular fragment containing the fourth premolar and first and second molars.

Dentition.

Molars. In the type specimen (No. 10,400) m. ^{1} and m. ^{2} are preserved of the superior series. The external face is continuous but strongly trilobate (Fig. 1*a*) with a pronounced external cingulum and prominent anterior accessory cusp. The third lobe of m. ^{2} is strongly produced beyond the junction of the posterior crest (Fig. 1). The transverse crests are rather low and obtuse, curving obliquely backwards. At the head of the main valley, directly opposite the median external lobe, is a low buttress. The internal cingulum is prominent, extending upon the anterior and posterior faces of the crown. The first molar is a smaller tooth of very similar pattern.

The third lower molar (Fig. 2) has a prominent crescentic heel. The anterior crests are stout and slightly oblique; the outer face shows a crescentic prolongation inwards, which is rather faint in the middle crest but is strongly produced in the anterior crest, the crescent thus formed being strengthened by a buttress. This buttress is a marked feature of the first and second lower molars, as seen in another individual (No. 10,399). In the latter the crowns are unworn (Fig. 11), the crests are subcrescentic; the buttress is very distinct in the concavity of the anterior crest and this crest extends inwards, forming an anterior valley.

Premolars. With the type specimen there is a superior premolar (Fig. 1) in which the internal lobe is single, with a slightly paired crest extending to the outer lobes. This tooth is almost unquestionably the second premolar. Associated with the third specimen also there are portions of the external lobes probably belonging to pm. ^{2}.

The fourth inferior premolar is preserved in each specimen (Figs. 2 and 11).

The anterior crest is lofty, bilobate, with a distinct anterior valley and buttress; the posterior crest is low, especially at the postero-internal angle. As shown in Fig. 11, the second and third premolars were bifanged, while the first premolar had a single fang and abutted closely against the canine as in *I. latidens*.

The Skeleton.

Axial. The vertebral and other portions of the skeleton, associated with the second specimen (No. 10,401), indicate that they belong to a young individual. All the vertebral centra, lacking the epiphyses, and the contours of the posterior faces of the carpals being incompletely developed. The *vertebræ* belong to the posterior dorsal and lumbar region; the centra are much flattened vertically and slightly keeled. Fragments of the cranium and infraorbital region are present, but are not characteristic.

Appendicular. Fore limb. The scapula has a suboval glenoid face, with a raised anterior border and the base of an apparently prominent coracoid process. The distance between the outer border and the rise of the spine is very narrow, indicating a rather short neck. The proximal portion of the *radius* presents a limited lateral extension, with rather deep antero-posterior diameter. These proportions, taken in connection with the rather broad carpus, indicate that *Isectolophus* had a short fore limb.

The *Carpus.* The most important portion of the skeleton is the nearly complete right carpus with portions of the second and third metacarpals attached. This is the first carpus discovered belonging to any genus in this line of descent and with the *cuboid* fully establishes the systematic position of *Isectolophus* in the tapir line, as already inferred from the peculiarities of its molar teeth. The vertical diameter of the carpus proper is considerably less than the transverse, the series retaining in great measure the rather spreading character of the primitive type. The first and second rows fully alternate and interlock. The *scaphoid* has a subquadrate anterior face; the radial facet has a broad posterior extension. The trapezium facet is worn away; the trapezoid facet is excavated and is only a trifle broader than that abutting against the magnum. The *lunar* has a symmetrical radial facet with a prominent posterior hook; the inferior face presents subequal magnum and unciform facets, with closely similar angles of inclination; this is a very distinctive feature. The *cuneiform* has rather a limited transverse extension of the ulnar facet, with a small pisiform facet; the lunar and unciform surfaces are subequal. The trapezium is not preserved, but is indicated by a wide facet upon the trapezoid and upon mc. II. The

trapezoid is small, subquadrate, with convex scaphoid and metacarpal facets and subequal trapezium and magnum facets. The *magnum* has a pentagonal face with subequal scaphoid and trapezoid facets; the remaining three sides articulate—*a*, with the lunar; this facet, although narrow in front, extends back to the full depth of the lunar; also presenting a narrow unciform facet posteriorly; *b*, with the extension of mc. III; *c*, with the horizontal face of mc. III and the extension of mc. II. The *unciform* has a broad cuneiform facet, and oblique lunar facet; the inferior face presents subequal facets for the extension of mc. III and the upper face of mc. IV. The facet for the fifth metacarpal is narrow upon the anterior face and is presented obliquely outwards and backwards. The full extent of this important facet cannot be ascertained, owing to a partial fracture and the immaturity of the individual.

The *second* and *third metacarpals* have subequal shafts with a rather flattened and slender section, indicating that they were not long and that the digits were rather short and spreading. The second metacarpal has a lateral trapezium facet, a concave upper face for the trapezoid and an extension for the magnum and mc. III articulations. The third metacarpal besides the above and the deeply concave *magnum* facet has a lofty extension and abutment against the unciform. The fourth and fifth metacarpals are missing; the latter was borne upon the oblique unciform facet; the rearward extension of the unciform which forms the principal support of the toe in the tapir appears to be undeveloped. The proximal phalanges probably belonging to these metacarpals are preserved; they are elongated and rather slender.

The only portion of the *tarsus* represented is the *cuboid*, which, however, presents important diagnostic characters. It is very short and cylindroidal. The superior face is subcircular, with a large hooked calcaneal facet and a comparatively extended facet for the astragalus. The outer surface is grooved for the flexor tendons. The lower facet apparently supported mt. II and a portion of mt. III. The vertical compression of the cuboid indicates that the navicular and cuneiforms were much flattened. The distal portion of mt. III is broad with a prominent posterior keel, while mt. II is considerably narrower with an oblique face.

The distal portion of the *tibia* shows a prominent malleolus and posterior spine. The astragalar grooves are slightly oblique, and decidedly shallower than in *Epihippus*.

Special Measurements, Skeleton.

Isectolophus, No. 10,401.

	M.
Cuboid, vertical diameter	.011
" transverse "	.0095
Distal face of tibia, transverse	.014
" " " antero-posterior	.020
Carpus, vertical diameter, maximum	.019
" transverse " "	.026

Other measurements may be obtained from the plates, which are carefully drawn to scale.

Dentition, Comparative Measurements.

	Upper series, pm^1–m^3.	*Upper molars m^1–m^3.*	*m^2 antpos-terior.*	*m^2 trans-verse.*	*Lower series, pm_1–m_3*	*Lower molars, m_1–m_3.*	*m_2 antpos-terior.*	*m_3 antpos-terior*
Isectolophus annectens.		.047*	.016	.018	.088*	.05*	.014*	.023
Isectolophus latidens.		.036	.012	.013	.081	.042	.012	.018
Systemodon tapirinum.	.063	.032	.0105	.012	.073	.035	.010	.016

The Systematic Position of Isectolophus.

Before discussing the relations of *Isectolophus*, we may review the grounds for referring this genus to a position in or near the direct tapir line: (1) As far back as the Wasatch and the overlying Wind River periods, we observe, as recently stated in full by Cope,† that a division in the lophiodont forms is indicated by the shape of the postero-external lobes of the superior molars; in one line they are conic, in the second or side line they are flattened. The former leads to the true type of tapir molar; the latter extends into another line of genera such as *Hyrachyus*, in which tapir characters were partly retained in the feet, but in which the teeth were rapidly departing from the tapir pattern; (2) another feature, to which Marsh first called attention as characteristic of this line, is the presence of a third lobe upon the lower molars; (3) a third feature is the absence of any considerable diastema behind the canine. So much for the dentition; the distinctive foot characters are more fully discussed later, they are: (4) In the carpus, the retention of subequal magnum and unciform facets upon the lunar, and the large mc. v facet upon the unciform; (5) the extension of the cuboid upon the astragalus, anteriorly and posteriorly.

The single tapiroid mark in *Helaletes* is the small third lobe of the last lower molar; in the flattened postero-external cusps, as in *Hyrachyus*, and in the high compressed tarsus resembling that of *Triplopus*, with its narrow astragalo-cuboidal contact, this genus widely departs from the tapir line. *Isectolophus*, on the other hand, has all these marks, and the points in which *I. annectens* varies from *I. latidens* are all in the direction of closer approximation to the recent tapir.

In *Systemodon* of the Wasatch (Cope Collection, see Tert. Vertebrata, Pl. LVI, Fig. 1–2), the third and fourth upper premolars have two external lobes and a

* Approximate estimate.

† The Perissodactyla. Am. Nat., 1887, p. 990.

single internal lobe. The third has a single transverse crest, and the fourth has the second crest just developing. In the true superior molars, the convex postero-external lobe is slightly posterior to the junction of the posterior transverse crest (metaloph), and there is a prominent cingulum embracing this lobe. In *Isectolophus latidens* of the Bridger, which is distinguished from *Systemodon* by the double internal lobes of pm.^{3} and pm.^{4}, the postero-external lobe is also slightly posterior to the crest, but in the Princeton specimen (*I. latidens*) there is no cingulum. Both these forms have slight diastemata in the dental series. In *I. annectens* the same lobe, which is homologous throughout with the primitive metacone of the tritubercular molar, is greatly produced beyond the junction of the posterior crest. The external cingulum reappears, so that in this respect, the genus reverts to *Systemodon*, but presents such a marked advance even upon the *I. latidens* molars in other respects that it must be considered a much more recent type. The third and fourth premolars probably show a more distinctly developed pair of internal lobes than in *I. latidens*. The inferior molars present the tapirine buttresses in the valleys and inflection of the anterior crests which are wanting in the Bridger species, but are occasionally seen in the Bridger varieties of *Hyrachyus*. Another developmental feature is the steady growth of the anterior accessory tubercle, which is so marked in the tapir. The comparative measurements of the teeth in these three genera show that, with the development of the molar pattern and metamorphosis in the premolars, there was a steady increase in size, extending proportionally in all parts of the dentition.

It thus appears that the primitive tapirs were well distinguished from the other lophiodonts very early in the Eocene period, and the tooth and foot structures characteristic of the recent forms were acquired even more rapidly than in the parallel line of primitive horses.

The Miocene successor of *Isectolophus* is undoubtedly represented by the single three-lobed lower molar from the White River beds, which Dr. Leidy has referred to *Lophiodon occidentalis*. By analogy with the premolar evolution in all other perissodactyls we may anticipate that this tapir will be found to have three premolars like the molars (*Mesotapirus*).

TRIPLOPUS Cope.

Syn.: *Prothyracodon*, nobis, Proc. Am. Phil. Soc., Sept. 2, 1887, p. 260.

This genus was discovered by Prof. Cope in the Washakie or Upper Bridger strata, and we find that it is very abundant in the overlying Uinta. The mandibular dentition so closely resembles that of the smaller species of *Hyrachyus* described

from the Bridger, that it is possible that some of the latter belong to *Triplopus*. As Cope has pointed out, this genus is near the *Hyrachyus-Hyracodon* series, as shown by the teeth and the reduced condition of the fifth digit. It was an extremely light and graceful animal, with long slender limbs and feet of the proportions seen in *Mesohippus*, and about the height of the smaller domestic sheep. The manus and pes are extremely elongate, the podials being laterally compressed, the metapodials spreading very little, much less apparently than in either *Hyrachyus* or *Hyracodon*. The peculiarity of the manus is that the lunar rests almost entirely upon the unciform anteriorly. In the pes the cuboid is elongate and articulates with the astragalus by a very narrow joint. The genus is distinguished from *Hyrachyus* by the flattening of the external molar crests and their backward extension, also by the advanced reduction of mc. v. From *Helaletes*, by the single internal lobes of the premolars 3 and 4. There is a wide diastema behind the canine and the last lower molar is without a third lobe.

This genus is represented in our collection by portions of five or more individuals; in every case the specific determination is uncertain and the generic reference of one specimen is somewhat doubtful. The types include the *Prothyracodon intermedium* (No. 10,403) and *Hyrachyus obliquidens* (No. 10,402) of our preliminary bulletin. The former type, together with several individuals which are represented by skeletal fragments, is now referred to the same species as the latter; the latter, a superior molar, m.^{3}, evidently belongs to *Triplopus*, and has associated with it a lower jaw which either lacks or has a rudimental first premolar, a good specific distinction from *T. cubitalis* Cope. The type of *P. intermedium* cannot be distinguished from *T. cubitalis*, except by indirect association with the *T. obliquidens* type.

Generic characters. Dentition, i. $\frac{3}{3}$, c. $\frac{1}{1}$, pm. $\frac{4\text{-}3}{4\text{-}3}$, m. $\frac{3}{3}$. A diastema behind the canine. Fourth and third premolars submolariform; upper third and fourth premolars with single internal lobes. External crests of superior molars flattened. Third lower molar bilobed. Skull, *meatus auditorius externus* closed by bone inferiorly. Tympanic expanding into a bulla. Posttympanic and paroccipital processes distinct. No postorbital arch. Manus and pes. Digits 3-3. Fifth metacarpal rudimental. Lunar resting principally upon unciform. Astragalus with slight cuboidal contact.

Triplopus obliquidens S. & O.

Plate XI.

T. obliquidens. Syn.: *Hyrachyus obliquidens*, nobis, Proc. Am. Phil. Soc., Sept., 1887, p. 259; probably also, *Prothyracodon intermedium*, nobis, *loc. cit.*, p. 260.

Specific characters. The transverse crests of the superior molars continuous; the first inferior premolar rudimentary or wanting.

Dentition.

The superior premolar-molar series (Fig. 6; type of *P. intermedium*, No. 10,403), consists of pm.^{3}–m.^{3}. The external crests of m.^{1} and m.^{3} are wanting, as well as the transverse crests of pm.^{3}. The external crests of the two *premolars* are subquadrate with two symmetrical vertical ridges (Fig. 6*a*). The anterior transverse crest of pm.^{4} is strongly recurved, forming the single internal lobe, against which the slender posterior crest abuts. The entire inner face is surrounded by a prominent cingulum. The peculiarities of the *molars* are, the elevation of the transverse crests, the concavity of the postero-external crest and faint marking of the vertical ridge. In m.^{2} and m.^{3} the external crest is produced widely beyond the posterior transverse crest, but in m.^{3} the external crest is very oblique and barely overlaps the posterior transverse crest, leaving no posterior fossa. These teeth closely resemble those of *T. cubitalis* as described by Cope,* but are slightly larger.

Measurements.	*M.*
Superior molars (10,403).	
Third premolar to third molar inclusive	.064
Second molar, antero-posterior diameter	.015
" " transverse "	.015
Fourth premolar, antero-posterior diameter	.01
" " transverse "	.0135
Inferior molars, etc. (10,402).	
Median incisors to third molars inclusive	.102
Length of the premolar-molar series	.076
" " molar series	.042
" " postcanine diastema	.012
" " symphysis	.035
Least width of "	.016
Antero-posterior diameter third superior molar	.017
Transverse " " " "	.014

The second specimen (10,402) is the type of *T. obliquidens*. It is intermediate in size between *Hyrachyus agrarius* and *H. nanus*. There are two mandibular rami (Fig. 7) with the symphysis complete and portions of the premolar-molar crowns; also a fragment of the maxilla with m.^{1} and m.^{2} and the complete crown of m.^{3} (Fig. 10). The latter tooth resembles that of the specimen above described so closely, that it enables us to identify this specimen, first ascribed to *Hyrachyus*, as belonging to

*Tertiary Vertebrata, p. 681.

Triplopus. The fangs of three subequal incisors and a medium sized canine are preserved, behind which is an extended diastema, followed in the left jaw by the minute alveolus of pm.[1] which may have been retained *in situ* at a less mature age. In the right jaw no trace of this alveolus can be seen. If this premolar is found to be invariably missing, this may be given as the generic distinction of *Prothyracodon.* The second premolar is rather small, the third and fourth are submolariform. The three *molars* are nearly equal in size with the ordinary lophiodont pattern, the anterior crest is well incurved in the worn condition of the crown. The mandible is stout and well rounded, contracting greatly opposite the diastema. The measurements indicate a heavier jaw and larger animal than the type of *T. cubitalis.* The last molar has no trace of the third lobe, but there is a considerable space between it and the ascent of the coronoid process.

The third specimen (10,397) is of unusual interest, since it contains, associated with a few teeth, many portions of the skeleton and the complete tarsus and carpus.

The Fore and Hind Limbs.

The fore limb of *T. cubitalis* has been fully described by Cope, *op. cit.*, p. 684. It is remarkable for the unusual elongation of the fore arm and of the manus. The head of the humerus is laterally compressed, with marked fore and aft extent; the distal trochlea is unusually deep and extensive, indicating great play at the elbow joint. The distal portion of the scapula has a very long neck, and the spine rises very gradually; the scapula was probably high and narrow. The proximal facet of the radius is very deep antero-posteriorly. The ulna is remarkable for the great extension of its olecranon; distally it is apparently more reduced than in *T. cubitalis.*

The extremities of the bones of the *hind limb* are mostly preserved, and indicate that the proportions were long and slender. The femur has a long patellar facet and a deep intercondylar pit. The tibia has a narrow but prominent cnemial crest and double spine; the distal face has a deeply excavated astragalar trochlea which is decidedly oblique. The fibula has a fairly stout distal extremity, and is throughout entirely distinct from the tibia.

The *carpus* (Fig. 6). The scaphoid is very stout with a deep radial facet; inferiorly it presents a minute facet for the trapezium, an oblique trapezoid facet, subequal with the slightly larger and horizontal magnum facet. The lunar has a nearly horizontal unciform facet and vertical ental facet which rests partly against the scaphoid and has a slight magnum contact. The cuneiform is very thin, and has a narrow ulna facet extending into that for the pisiform. The trapezium was

extremely reduced. The trapezoid is wanting. The anterior face of the magnum is subquadrate, since the ectal lunar and unciform facets are in the same slightly oblique line. The unciform is remarkable for its depth; superiorly it has subequal cuneiform and lunar facets; inferiorly it has subequal mc. III and IV facets and a small facet for the rudiment of mc. V. The metacarpals have sharp distal keels confined to the deep posterior faces. The phalanges are deep and elongate.

The *tarsus* (Fig. 9). The main features of both the carpus and tarsus are described in the section on the feet of the Perissodactyla. In addition the following features may be mentioned: The sustentaculum of the calcaneum is very narrow; the cuboidal facet slants obliquely downwards as in the Artiodactyla. The metatarsals have the proportions seen in *Mesohippus*.

Measurements may be obtained from the natural size figures upon Plate XI.

The Systematic Position of Triplopus.

Prof. Cope (Tert. Vert., p. 678; Am. Naturalist, 1887, p. 999) has placed *Triplopus* in a distinct family. He says: "The entirely rudimentary character of the fifth metacarpal, which with its digit is so well developed in *Hyrachyus*, places *Triplopus* in another family and in a distinct line of descent. I think that it must be regarded as one of the forms connecting the lophiodonts with the rhinoceroses." We cannot accept this conclusion. In the discussion of the manus and pes in the *Hyrachyus-Hyracodon* series, on a later page, it is shown that the feet of *Triplopus* are in every detail intermediate in structure between those of the above Bridger and White River genera. The teeth are also transitional. In the upper molar series of *Triplopus*, from the third premolar to the last molar inclusive, the external faces have a striking resemblance to those of *Hyracodon*, while the wearing surfaces of the same teeth are close to those of *Hyrachyus*. The departure from the *Hyrachyus* pattern is seen, first, in the decided elevation of the crests and disappearance of the postero-external lobe or ridge; second, in the rhinocerotic shortening of the posterior transverse crest of m. ^{3}; both these changes are in the direction of *Hyracodon*.

These characters suggest our considering the genus *Triplopus* as a transition form. None of the known species, however, exactly fill the requisite transition features. *T. cubitalis* and *T. obliquidens* are apparently to be considered aside from the main line, on the following grounds: The fore arm is proportionally much longer, the metapodials are more compressed, the lateral elements of the pes especially are more reduced than in any possible direct ancestor of *H. nebrascensis*. A smaller, lighter species of *Hyracodon* is, however, represented in the Harvard collection by a carpus which while slightly larger than that of *T. obliquidens* presents a very similar

stage of reduction of the lateral metapodials. This is further evidence that some species of the Lower Miocene genus will be found to approach Triplopus much more closely than *H. nebrascencis* does. The upper molars of the known species of *Triplopus* entirely lack the rhinocerotic "anticrochet" seen in *Hyracodon*, and are also devoid of the strong external cingulum.

Another feature of *Triplopus* should, however, be mentioned, which may serve to justify Prof. Cope's views of its separate systematic position, that is, the apparent expansion of the tympanic into a small auditory bulla. The *meatus auditorius externus* is completely enclosed below, whereas both in *Hyrachyus* and *Hyracodon* it is widely open.

We probably have in *Triplopus* a highly specialized cursorial type in which there is a slightly more marked tendency to monodactylism than in the predominant species of either *Hyrachyus* or *Hyracodon*. A recently completed restoration of *H. nebrascencis* from materials in the Princeton and Harvard Museums shows that the Miocene genus retained substantially the proportions of *Hyrachyus eximius* as seen in the complete skeleton discovered by Cope.

EPIHIPPUS Marsh.

This genus is represented by the lower jaw and numerous portions of the skeleton of a single young individual (No. 10,405). The species cannot be determined. The specimen is provisionally referred to *E. uintensis* Marsh.

Generic characters. Dentition, i. $\frac{3}{3}$, c. $\frac{1}{1}$, pm. $\frac{4}{4}$, m. $\frac{3}{3}$. The third and fourth upper premolars are like the molars, and the corresponding lower premolars have the double antero-internal cusps (*a a* Rütimeyer). The ulna is complete and distinct from the radius. The lunar rests equally upon the magnum and unciform. Digits 4–3.

Epihippus uintensis Marsh.

Plate XI.

Dentition. The lower jaw is shallow, tapering to the narrow, slender symphysis. The incisor fangs (Figs. 3, 3*a*) are equidistant and subequal. The canine is considerably larger. The first premolar has a simple pointed crown and single fang. The premolars 2–4 are missing. The second molar has the characteristic reduplication of the antero-internal cusps. From the antero-external cusp (protoconid) a sharp ridge extends downwards and inwards; there is a well-defined external cingulum. The third molar shows the same characters with a strong posterior cingulum. The superior teeth are not preserved.

Fore limb (Figs. 4, 4*a*). The distal portion of the humerus shows an extensive trochlea and deep anconeal pit, but no perforation. The proximal portion of the radius entirely conceals the ulna; the shaft is arched forward, strongly convex in front; the ulna descends along the flattened posterior surface and appears at the side in the lower third of the shaft. The ulna has a small pisiform and narrow unciform facet. The characteristics of the carpus are fully described elsewhere and well shown in the figures. The third metacarpal does not show the increased size we should have anticipated in this genus, but would probably be relatively much larger in an adult individual. The fifth metacarpal is about three-fourths the length of the second and fourth. The phalanges are rather short and stout. The ungual phalanges spread distally. The metapodial keels are very prominent on the posterior face.

Hind limb. The tibial shaft is preserved, but is not characteristic. The tarsal characters (Fig. 5) agree closely with those of *Hyracotherium*, and are fully described elsewhere. The astragalus has a very deep groove, narrow navicular facet, narrow cuboidal contact, and three distinct calcaneal facets. The calcaneum has a distinct fibula facet and rather short stout tuber; the sustentaculum is very narrow. The third metatarsal is very deep and much stouter than the second and fourth, which are strongly rotated backwards. The second metatarsal apparently articulates laterally with the ectocuneiform.

Taken altogether *Epihippus* preserves more of the primitive characteristics of *Hyracotherium* than we should have anticipated. These are especially seen in the carpus. The tarsus shows more marked reduction of the lateral members. The fibula is probably still complete.

Part IV.

BY HENRY FAIRFIELD OSBORN.

THE EVOLUTION OF THE UNGULATE FOOT.

In the Uinta and underlying Washakie beds we meet with, at least, five distinct series of Perissodactyla, representing the recent Tapiridæ and Equidæ, also the Titanotheriidæ and Hyracodontidæ, which became extinct in the Miocene, and Amynodontidæ which may have given off the true rhinoceros line. The foot bones of each of the series are fortunately represented wholly or in part in the Princeton collection and present interesting transitions to the Bridger types of feet on the one side and the White River on the other. Many notes upon the latter have been derived from the study of the collection in the Museum of Comparative Zoölogy through the courtesy of Prof. Agassiz. The writer is also greatly indebted to Prof. Cope for free access to his collection which is so rich in Lower Eocene forms.

A careful comparison of these earlier and later forms showed it to be possible to distinguish, in nearly every instance, the separate elements of the feet in each series by a number of inconspicuous but thoroughly diagnostic marks. This led the writer to a study of the minor characteristics of the foot bones in the recent and extinct Perissodactyla and the earlier Ungulata in general. Kowalevsky has given us a model for such research in his Anchitherium memoir, in which structural modification is constantly viewed from the functional standpoint, while we are greatly indebted to Cope for his numerous essays upon the broad lines and philosophy of the transitions from the taxeopod to the recent ungulate foot. The purpose of the present contribution is to indicate the chief characteristics of the foot bones in each of the phyla diverging from the primitive Taxeopoda, chiefly in their bearing upon phylogenetic questions and the laws of modification of foot structure. The subjects may be conveniently treated in the following order:

I. The foot structure in the ancestral Taxeopoda or Protungulata and the modifications which take place in the ungulates in general in the evolution from the primitive type.

II. The main features of the manus and pes in the Hyracoidea, Amblypoda, Proboscidia, Toxodontia, and in Macrauchenia.

III. The chief and minor characteristics of the manus and pes in the various series of Perissodactyla.

IV. The taxonomic value of the primitive and secondary articulations in the manus and pes.

V. The laws of modification of foot structure.

I. THE PRIMITIVE FOOT.

The more recent types are connected with the remarkably simplified feet of the Puerco ungulates by *Phenacodus;* without this link it would be presumption to describe the feet of such genera as *Periptychus*, *Ectoconus*, and *Meniscotherium*, as ungulate, since, excepting in the terminal phalanges, they resemble the plantigrade carnivore foot far more closely than those of any living ungulate—possibly excepting Hyrax.

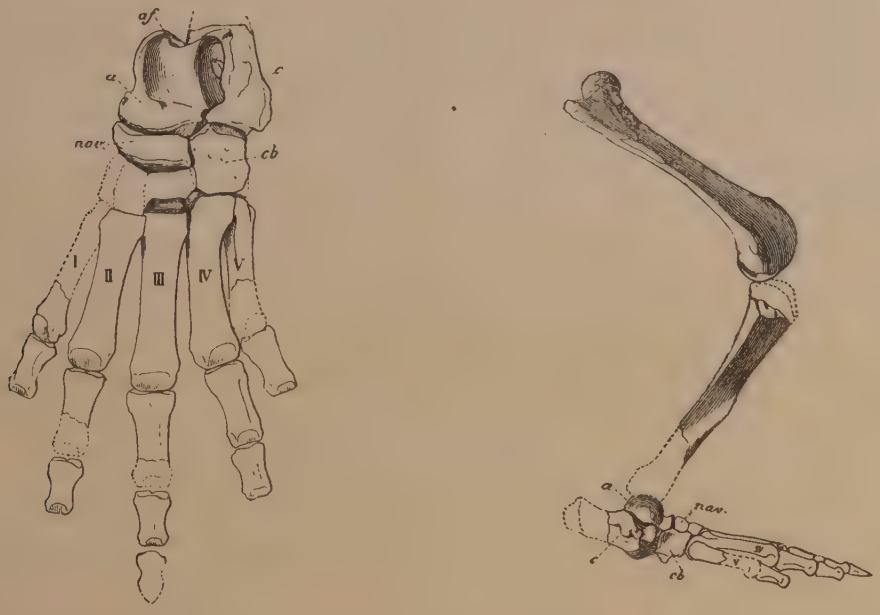
The pes of the Puerco *Periptychus* and *Pantolambda* are fully known. The former corresponds so closely with that of *Ursus*, we may anticipate a similar homology in the manus, especially as the entire structure of the upper portion of the fore limb is bear-like. Our actual knowledge of the primitive taxeopod manus is at present inferential from *Phenacodus* in comparison with the more recent types in which taxeopod characteristics persist—as in most cases we can readily detect and eliminate secondary structures.

General characters. The primitive manus and pes of the lowest Eocene ungulates had five spreading digits bearing spatulate terminal phalanges marked by a median groove. The first and fifth digits were short. The separate elements of the podium and metapodium were articulated serially, the only interlocking joints being, as in all mammalia, beneath the scaphoid and unciform, cuboid and navicular. In standing, the entire sole rested upon the ground, the foot forming a right angle with the lower leg; the limited astragalo-tibial facets in all the Puerco forms leave no doubt upon this point, and we have a persistent example of this type in *Hyrax*.

THE PES. In the pes both the tibia and fibula were supported upon the astragalus; a fibulo-calcaneal facet is frequently assigned as one of the characteristics of the primitive ungulate foot,* from the fact of its appearance in so many different phyla. Among the primitive Ungulata this facet has thus far been observed only in *Meniscotherium*, it is wanting in all the other Condylarthra. (1) In this genus it has

* See Marsh, Dinocerata, Characters of the *Protungulata*, p. 171.

a trochlear character, the fibula resting upon the calcaneum throughout extension, as in *Macrauchenia* and the Artiodactyla. (2) In the primitive Equidæ and in the Titanotheridæ, the fibula rests upon the calcaneum in extreme flexion. In ancestors of the latter family we observe this facet developing evidently as an adaptation to great body weight. (3) The third type of fibulo-calcaneal facet, as seen in the Proboscidia, (?) Dinocerata, and Toxodon,* in which the ankle motion is limited and the fibula rests broadly upon the calcaneum, is also probably a secondary adaptation to weight. As in several instances this facet has been acquired secondarily, as it is wanting in the majority of primitive taxeopods, and is not essential to the perfect working of the plantigrade ankle joint—the evidence as to its primitive character is certainly not conclusive.†



A *B.*

DIAGS. 6–7.—Hind limb of *Periptychus rhabdodon* Cope, from original in the Cope collection. *A*, Front view of pes, × ½; *B*, Side view of right hind limb, × ¼. The restored and conjectural portions are in dotted lines. *af*, Astragalar foramen.

The trochlear groove of the *astragalus* faced upwards, when the foot was prone, and with its slight concavity and obtuse edges allowed considerable lateral movement. The antero-posterior movement was evidently very limited, for this facet in all the Puerco genera is small; it was indented by a foramen probably transmitting the *flexor digitorum communis*. The importance of this astragalar foramen as

* "In *Toxodon* the fibula articulation is of unusual size." Cope, Proc. Am. Phil. Soc., April, 1881, p. 402.

† We are speaking of primitive ungulates, not of primitive Mammalia in general.

a characteristic of the Ungulata and primitive Mammalia generally has been hitherto overlooked. Cope has observed it in *Bathmodon** and in *Periptychus*;† Marsh has described it as present in about one-half the *Uintatherium* astragali.‡ Lemoine§ has found it in all the Cernaysien mammals, which are of about the same age as the Puerco. It is also present in *Ectoconus*, *Meniscotherium*, *Pantolambda*, and in many if not all of the Puerco creodonts. The astragalus had a short neck articulating distally mainly with the navicular by an oval and strongly convex facet, and, while in several Puerco genera (*Periptychus*, *Pantolambda*), it has a considerable ectolateral facet for the cuboid, this facet was probably absent in the most primitive forms. Another important feature was the articulation with the calcaneum by two facets only, the ectal (posterior) and sustentacular (see *Phenacodus*, Diagram 10).

The *tibiale*.‖ A careful comparison of the tarsus of *Periptychus* and *Dendrohyrax* has brought out the interesting fact that there is a broad ental facet upon the astragalus in some of the Taxeopoda for the tibiale similar to that in the Hyracoidea. This facet, which Cope has recognized as the tibiale or "internal navicular" in *Periptychus*, is also observed in *Meniscotherium*, *Pantolambda*, and the Puerco mammals generally. It has been pointed out by Baur in *Uintatherium*, by Cope in *Bathmodon*, and should undoubtedly be added to the list of primitive characters of the pes.

The *calcaneum* resting upon the ground with its sustentaculum bore the whole weight of the leg transmitted through the astragalus, articulated distally by a concave facet with the cuboid. The cuboid supported mts. IV and V, the three subequal cuneiforms articulating respectively with mts. I, II and III. A very constant feature was the relative shortening of the mesocuneiform (*Phenacodus*), so that the proximal portion of the mt. II was inserted between the endo- and ectocuneiforms. A similar facet may be present between mt. III and the cuboid; these ectal facets being analogous to those upon mcs. II and III in the manus in not being of a supporting character; in other words, there was no true displacement between the podium and metapodium.

THE MANUS. There was in all probability a centrale occupying the same position as in *Hyrax*, for this element has now been found both in the Hyracoidea and

* Tertiary Vertebrata, p. 551.

† *Op. cit.*, p. 399: "This foramen is formed by the closing of the usual tendinous notch," etc.

‡ Dinocerata, p. 148.

§ Various papers upon the Cernaysien fauna.

‖ Baur, On the Morphology of the Tarsus in the Mammals, American Naturalist, Jan., 1885, p. 349. See also, Marsh, Dinocerata, p. 146.

Proboscidia.* The distal row of carpals was probably much broader than the proximal, and the metapodials, as in the pes, were without any lateral facets.

General Modification of the Feet.

The primitive structure, as Cope has shown, is approximately preserved in the plantigrade *Hyrax*, showing that all the secondary articulations in various ungulates were adaptations to digitigradism. There are four stages in the foot elevation: First, the plantigrade, already described; then the semiplantigrade, seen in the feet of the Proboscidia and Dinocerata, with short slanting metapodials well raised proximally. Rütimeyer has proposed "digitiplantigrade" for the reduced types with elongate vertical metapodials in which the phalanges rest fully upon the ground (*Camelus*). As this condition is practically analogous to that in one division of the Carnivora, it may be more simply described as digitigrade. There are of course many steps between this condition and the unguligrade foot, in which the terminal phalanges alone rest upon the ground (*Equus*).

The universal result of elevation of the wrist and ankle joints was displacement in some form, from the serial order, adapting the foot bones to the new incidence of impacts and strains. Then came reduction of one of the lower leg bones and of the lateral digits. With one exception, seen in the proboscidian manus, the departure from the serial type was upon a single principle: First,† the II and III metacarpals and metatarsals acquired lateral supporting facets upon the second row of podial elements, usually upon the outer side. Second, the bones of the upper row of carpals and tarsals formed articulations with the more ectal elements of the second row.

In the general modifications of the Manus it is important to note that mcs. II and III invariably acquired supporting facets upon the ectal side with the magnum and unciform respectively. Excepting in the semiplantigrade orders the reduction of the first digit was very rapid, it being already absent or functionless in the Eocene Diplarthra. The extension of the lunar was the next step in displacement; spreading upon the trapezoid in the Proboscidia, or upon the unciform, by its own growth or that of the unciform beneath it, in all other ungulates. This is incipient in *Phenacodus* and extensive in the Amblypoda. In other phyla the displacement of

* Rütimeyer, Ueber einige Beziehungen zwischen den Säugethierstammen Alter und Neuer Welt, Zurich, 1888.

† See Marsh, Dinocerata, p. 183, § 2: That the metapodial displacement was more primitive than the podial is shown both in *Phenacodus* and *Hyrax*, in which mcs. II and III abut laterally against the magnum and unciform, while the carpals are serial.

the scaphoid and lunar was probably concomitant.* In the earliest known Diplarthra the scaphoid has a facet upon the magnum of the same width as that of the unciform beneath the lunar—these facets increase, *pari passu*, until we reach the most specialized forms. In all the Perissodactyla the law of ectal displacement of the metacarpals is maintained; after mc. I disappears the trapezium persists; as mc. II is reduced it invariably retains its entire hold upon the trapezoid; mc. III spreading only to the ectal side (Kowalevsky). In the adaptively reduced Artiodactyla, however, mc. III acquires a broad trapezoidal facet, forming an exception to the otherwise universal rule.

The general modifications of the PES are still more interesting. In the astragalus the flexor foramen disappeared, being for a long time represented by a groove; the primitive foot undoubtedly had a limited grasping power, the flexion being distributed between the metapodials and phalanges; this was replaced by the greatly increased play in the ankle joint and the development of the muscles inserted in the *tendo achillis* as propellers. The trochlear groove deepened, limiting the motion to the fore and aft direction (Cope); the navicular facet became saddle-shaped and then flat, excepting in the artiodactyl phylum; the sustentacular facet divided into two, which may be called the "sustentacular" and "inferior," producing three distinct calcaneal facets.† The displacement of the astragalus and cuboid by reciprocal growth was almost universal, having but two exceptions, in the Proboscidia, where the navicular extended upon the cuboid, and in the lines of Perissodactyla, which tended to monodactylism. The calcaneum in several series acquired a fibular facet, the tuber was elongated and the sustentaculum extended inwards. While rarely in contact with the navicular anteriorly (as in the primitive horses), the calcaneum in some

* Upon this point hangs the question whether the diplarthrous foot ever passed through the amblypodous stage, as held by Cope. In the absence of any direct palæontological evidence, Schlosser (Beiträge z. Stammesgeschichte der Hufthiere, p. 6) has strongly insisted upon the direct derivation from the Condylarthra upon the ground of the dissimilarity both in foot and tooth structure. His objections, though well taken, indicate a misunderstanding of Prof. Cope's taxonomic principle of selecting genera at a certain stage of evolution in foot or tooth structure, to form a family or order, irrespective of actual descent or relationship. When, upon this system, the derivation in question is maintained, no genetic relationship of the Perissodactyla and known Amblypoda is thereby implied, but that at one stage in the evolution of the diplarthrous foot the lunar rested widely upon the unciform, as in *Coryphodon*, the scaphoid not reaching the magnum. This proposition seems to us highly improbable, for we must suppose that the lunar first extended upon the unciform while retaining its entire magnum facet, then it became reduced while the scaphoid extended upon the magnum—this hypothesis is rendered improbable by the fact that in all the early Diplarthra the scapho-magnum and lunar-unciform facets are subequal. The proboscidian manus is an exact counterpart to the amblypod manus, and shows that the latter is to be considered not as in an intermediate but as in a final stage of development.

† It is interesting to note the close parallelism to these adaptations to digitigradism in the Carnivora; we observe an entirely analogous division in these facets and evolution of the ankle joint.

series acquired a posterior navicular facet. The reduction of the entocuneiform followed that of mt. I. The fifth digit was much more rapidly reduced than in the manus. Independently of these reductions, mt. II and mt. III formed oblique supporting facets with the ectocuneiform and cuboid respectively analogous to the "alternating" metacarpal articulations, but the metatarsal articulations were much more variable than the metacarpal. As a general rule metatarsal displacement and growth was to the ectal side, the exception being in the Equidæ, where mt. III extended rapidly over the mesocuneiform.

The *metapodials*. In all the perissodactyls, primitive artiodactyls, and inadaptively reduced artiodactyls we find, as above stated, but one alternating type of metacarpo-carpal articulation; the adaptively reduced artiodactyls develop a second type of metacarpal articulation. In the *pes*, beginning with the "serial" type of *Phenacodus*, we find that genera tending to monodactylism develop what may be called the "plane-serial" type, in which there is for a period no lateral spreading (*Hyracotherium*). The "reverse" type is exemplified in *Aphelops* and *T. indicus*, in which the second and fourth metatarsals both acquire ectocuneiform facets. The alternating type is developed in the *Titanotherium* tarsus and some other Diplarthra precisely as in the carpus. Each of these types has, of course, its functional significance.

We may now consider some of the special characteristics of the manus and pes in the five side lines. While observing many features which point back to the common taxeopod stem form, there are few or none which indicate any nearer mutual affinity than this.

II. THE HYRACOIDEA, AMBLYPODA, PROBOSCIDIA, Etc.

1. Hyracoidea.

An important fact is brought out by the comparison of the feet of *Hyrax* and *Dendrohyrax*. The manus and pes are absolutely plantigrade. In both, the carpals are arranged in strictly serial order, as described by Cuvier and Cope, although the metacarpals show decided lateral displacement. But in the tarsus of *Hyrax* the calcaneum rests exclusively upon the cuboid, and, as in *Phenacodus*, the calcaneocuboidal articulation is actually in some cases below the level of the astragalo-navicular.* In *Dendrohyrax* (*H. arboreus*, Princeton Museum), also from the Cape, the

* These relations were found by removing the skin and fascia from the foot of a dried specimen in the Cope Collection. De Blainville's figures of *H. capensis* and *H. syriacus* show these facets on the same level.

astragalus has quite a broad cuboidal facet. The striking difference in the pes of these two genera bears directly upon the question of the taxonomic value to be attached to these articulations.

Other features of the feet are the interlocking tibio-astragalar joint, the probable presence of a *tibiale*, the *centrale* in the carpus, the reduction of mts. I and V in the pes.

2. Amblypoda.

Cope has described the feet in this order as "plantigrade" ("Tertiary Vertebrata," p. 507). This term, which has also been generally applied to the proboscidian feet, should now be restricted to the types in which the entire foot rests on the ground. The Puerco *Pantolambda** was probably plantigrade. The position of the metapodials in the Pantodonta and Dinocerata as indicated in the figures of Marsh ("Dinocerata," p. 184) was analogous, the wrist and ankle joints in each being well raised from the ground. Our own study of the tarsals of *Coryphodon* has, however, convinced us that the pes was almost plantigrade, while the manus was semi-plantigrade.

The metacarpals II and III are displaced, alternating upon the magnum and unciform. The intercarpal displacement is unique; the lunar has a broad foothold upon the unciform, while the scaphoid has either no magnum facet (*Coryphodon, fide* Cope) or rests by a considerable posterior facet upon the magnum† as in some species of *Uintatherium*. The cuneiform rests partly upon mc. V.

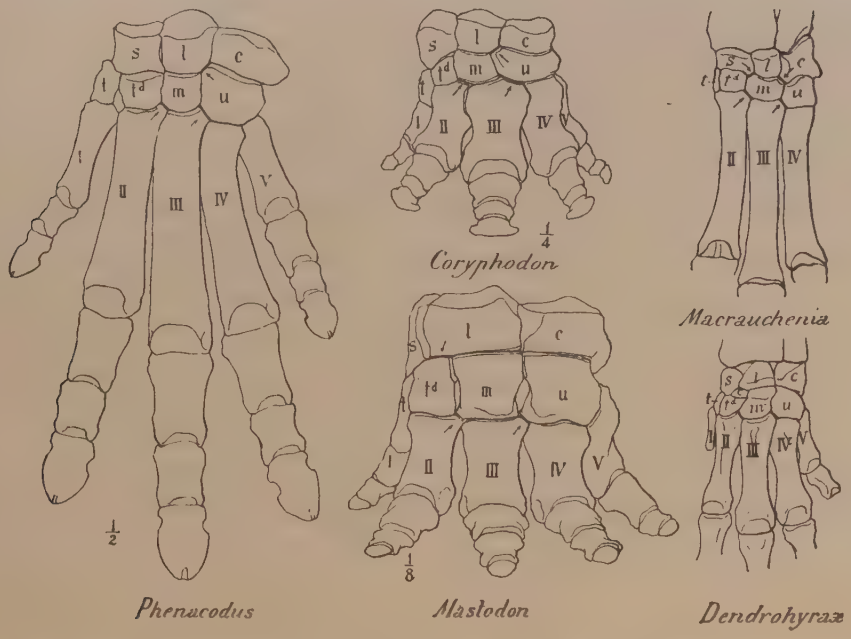
In the tarsus Baur called attention to the facet probably for the *tibiale* upon the astragalus of *Coryphodon*‡ and *Uintatherium*. The displacement is extreme, the astragalus extending the entire breadth of the foot in front, covering both the navicular and three-fourths of the cuboid. The astragalar foramen is frequently present in *Coryphodon* (see Cope, *loc. cit.*) and in *Uintatherium* (see Marsh, "Dinocerata," p. 148). The calcaneum has the primitive ectal and sustentacular facets, and the fibula occasionally came in contact with it (*Uintatherium*, Marsh, *op. cit.*, p. 152). The metatarsal articulation is of the "reverse" type, mts. II and IV articulating laterally with the ectocuneiform. The Amblypoda with unreduced digits, very short spreading

* Placed by Cope in the Amblypoda.

† In his definition of the Amblypoda, Prof. Cope says ("Tertiary Vertebrata," p. 378): "Scaphoid supported by trapezoid and not by magnum, which with unciform supports the lunar." See also, Amer. Naturalist, Nov., 1884, p. 1110. While this definition may apply strictly to *Coryphodon*, it cannot to *Uintatherium*. Of three carpal series in the Princeton Museum, two show a broad scaphoid facet upon the posterior half of the magnum, the third has none In Marsh's "Dinocerata," the lithographic figure on Plate LIV is incorrect; the wood-cut, Fig. 152, is approximately correct; the scapho-magnum facet is not indicated in Fig. 113, but is well shown in Plate XXXIV, Fig. 5, see page 113.

‡ Cope, however, separates *Coryphodon* by the absence of a tibiale, from *Bathmodon*, in which it is present.

metapodials and peculiar carpal displacement, a foot type adapted to animals of heavy bulk, really present a striking analogy to the Proboscidia and an intermingling of primitive with acquired characters.



DIAG. 8.—The displacement of the bones of the manus in the Ungulata, I. *Phenacodus primævus*, from original in the Cope collection. *Coryphodon hamatus*, after Marsh. *Dendrohyrax arboreus*, from original in the Princeton collection. *Macrauchenia patachonica*, after Gervais. *Mastodon Americanus* from original in Princeton collection. The oblique arrows indicate the direction of displacement.

3. PROBOSCIDIA.

Weithofer* has recently directed attention to the unique departure from the taxeopod condition of the carpus in this order—the lunar spreading upon the trapezoid, *i. e.*, to the ental side, instead of upon the magnum. In *Mastodon arvernensis*, *Elephas meridionalis* and *E. antiquus* from one-fourth to one-fifth of the inferior face of the lunar rests upon the trapezoid. We find the same condition in *Mastodon Americanus*.

This author attributes this to the enlargement of the ulna and its extension upon the lunar *vs.* the radial enlargement in all other ungulates. This displacement is variable, since it actually recedes and sometimes disappears (*op. cit.*, p. 515) in the adult recent forms (*E. Indicus*, *E. Africanus*). Burmeister moreover has figured† the carpus of a specimen of *M. Humboldtii*, in which the lunar spreads both upon the trapezoid and magnum. Another primitive feature of the carpus is the recently

* Einige Bemerkungen über den Carpus der Proboscidier. Morph. Jahrb., 1888, p. 507.

† Ann. del. Mus. Publ. d. Buen. Ayres, Plate XIV, p. 287.

discovered centrale.* The distinctive features of the tarsus have long been recognized, viz., the extension of the navicular with the astragalus above the cuboid, and the fibulo-calcaneal facet.

4. Toxodontia.

Prof. Cope† has found a striking resemblance to the proboscidian pes in *Toxodon*. The astragalar and fibular facets of the short calcaneum are subequal and face upwards, the cuboid facet is on the inferior face of the extremity of the calcaneum and faces downward. The astragalus has probably no cuboid facet; its navicular facet is plane and truncates the bone somewhat inferiorly as well as distally. The metapodial elements are robust and short, the distal metatarsal keels are posterior and rudimental; the proximal faces have lateral facets indicating a slight displacement. The number of digits is uncertain, the lateral ones are reduced in length, but robust. "The posterior feet were more truly plantigrade for the extremity of the calcaneum reached the ground." The instep was raised, forming an arched angulate type of foot. If this description is correct, this foot is more primitive than that of the Proboscidia.

5. Macrauchenia.

The feet of *Macrauchenia* have some striking peculiarities. The lateral displacement in the carpus and tarsus so characteristic of all the Perissodactyla is absolutely wanting in the tarsus and aberrant in the carpus. As Burmeister pointed out in his most recent paper‡ (p. 263) a gap exists in the usual point of junction of the calcaneum, cuboid, astragalus and navicular. The astragalus is entirely separated from the cuboid and even from the calcaneum, the navicular participating in this separation. His description and figures strikingly suggest the arrangement of the tarsals of the dog in this region. The calcaneum has but two astragalar facets, the sustentacular and inferior having coalesced, as in some species of *Palæotherium*, *Rhinoceros*, and the Hyracodontidæ; its distinctive feature is the extensive fibular trochlea, very similar to that in the Artiodactyla, and functionally unlike those observed in the primitive Equus and Titanotherium series. The carpus is also

* Rütimeyer, *op. cit.*, page 11, foot-note.

† Note on the Structure of the Posterior Foot in *Toxodon*. Proc. Am. Philos. Soc., April, 1881, p. 402.

‡ Neue Beobachtungen an Macrauchenia Patachonica. Nova Acta der Ksl. Leop.-Carol. Deutschen Akademie der Naturforscher, Bd. XLVII, Nr. 5, pp. 239–267 (Nachträgliche Beschreibung der Fusswurzel von Macrauchenia). Also, Descripcion de la Macrauchenia Patachonica. Ann. del. Mus. Publ., Buenos Ayres, Tom. i, p. 32–66.

unique, in the fact that while the scaphoid has acquired an extensive magnum facet, the lunar is extremely small; the magnum is large and not only excludes the lunar from the unciform, but actually has a cuneiform facet. Burmeister describes facets for lateral digits upon the pes.* The metapodials are strongly keeled.

Schlosser† lays great stress upon the primitive character of this animal as shown in the serial disposition of the foot bones and the epicondylar foramen of the humerus. In his earlier paper (Zool. Anz., p. 683), he placed this genus with the Perissodactyla; later he separated it: "Fasst man alle diese Merkmale zusammen, so kann man kaum entschliessen *Macrauchenia* den Perissodactylen beizuzählen" (Morph. Jahrb., Bd. XII, 1886, p. 22). Upon this it may be observed that the arrangement of the carpals is not serial, as he intimates, but has a peculiar adaptive displacement. The fibulo-calcaneal facet may be considered a secondary character (see p. 533). We can in fact only conjecture the phylogenetic position of this genus, with its extraordinary mixture of characters. Upon the whole it is more nearly related to the perissodactyl than to any other phylum, and is possibly an offshoot of the primitive mesaxonic stem, separating from the main line at a period corresponding to the Wasatch.

III. THE PERISSODACTYLA.

When we examine the Diplarthra as a whole, after reviewing the unrelated and widely divergent groups which have already been considered, in which the displacement of the carpals and tarsals presents little or no analogy, we find in contrast a very striking uniformity in the displacement of the upper elements to the outer side, *i. e.*, in the carpus, the scaphoid articulates with the magnum in the same degree that the lunar articulates with the unciform; in the tarsus, the astragalus invariably extends upon the cuboid. This is the universal law of displacement which is subject to variation in degree only. It characterizes the stem forms of every family, and is secondarily modified by growth arising from special causes.

We may begin with a type in which the displacement is least extreme, and will here consider only the Perissodactyla.

* *Op. cit.*, p. 265, "Obgleich *Macrauchenia* nur drei vollständige Zehen an jedem Fusse besitzt, so sind doch Resten von zwei anderen, wenigstens am Hinterfusse vorhanden gewesen, wie die Gelenk-facetten am Astragalus und Naviculare, gleich wie am Cuboideum beweisen."

† Zur Stammesgeschichte der Hufthiere. Zool. Anzeiger, No. 210, 1885, p. 683. Also, Beiträge zur Kenntnis der Stammesgeschichte der Hufthiere. Morph. Jahrb., Band XII.

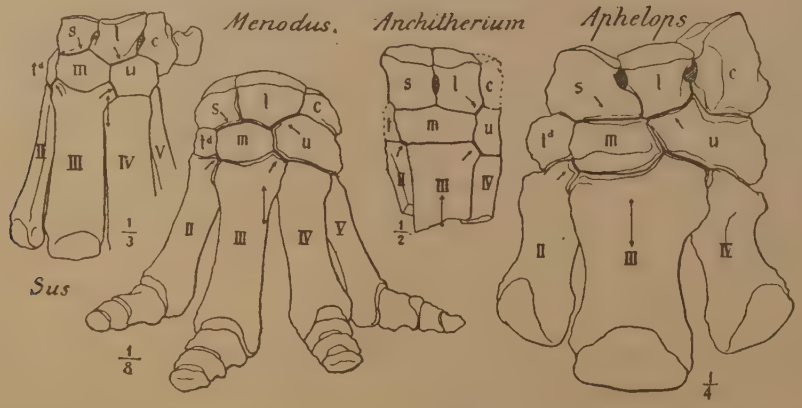
1. The Tapir Series.

In *Isectolophus* (No. 10,401, Princ. Coll.), from the Uinta beds, we have a genus which is in or near the line of the true tapirs. It is represented by the almost complete carpus and a single element of the tarsus, the cuboid. (See full previous description, also Pl. X, Fig. 3.)

The *carpus.* The elements of the carpus are broad relatively to their height. The scaphoid has a horizontal trapezoid facet and slightly oblique magnum facet; thus its main weight is borne by the former bone. The lunar is large and has a slightly larger unciform than magnum contact, but it may be said to rest equally upon these bones. The cuneiform divides the upper surface of the unciform with the lunar. The magnum articulates with the scaphoid, lunar, trapezoid, unciform, and distally with the metacarpals II and III. The carpo-metacarpal articulation is of the usual alternating order. The unciform has inferior facets for metacarpals IV and V.

The *tarsus.* The cuboid is subquadrate in shape when viewed from in front and from above and proximally has a small astragalar facet.

No intermediate forms have been described. The manus and pes of the recent *Tapirus indicus* do not show a very wide divergence from the type above described. The scaphoid is enlarged posteriorly and besides its trapezium facet has subequal and horizontal trapezoid and magnum facets. The lunar has a relatively larger unciform facet, but still rests directly upon the magnum by a horizontal facet which is variable in width. The cuboid is subquadrate and partly supports the astragalus. The tarso-metatarsal articulation varies in different species. In *T. indicus* both mts. II and IV abut against the ectocuneiform.



Diag 9.—The displacement of the bones of the manus in the Ungulata, II. *Sus scrofa*, illustrating the typical adaptive displacement in the Artiodactyla. *Titanotherium* (*Menodus*), from original in Harvard collection; *Anchitherium aurelianense*, after Kowalevsky; *Aphelops*, from original in Harvard collection. The oblique arrows indicate the direction of displacement; the double vertical arrows indicate the mesaxial line of the foot.

2. The Equus Series.

The equine series is the most complete known, and is well distinguished from the others by the fact that the effects of lateral displacement in the carpus, which are well advanced in the Eocene members, although never extreme, are subsequently counterbalanced, and practically lost sight of, in the growth of the bones in the median line resulting from monodactylism. In the tarsus the displacement is very limited and is not similarly retrogressive. It is surprising to note the constancy in size and shape of the small astragalo-cuboid articulation from the Wasatch *Hyracotherium* to the recent horse; secondly, the early appearance of minor equine marks in the manus and pes. The displacement or diplarthrism is thus limited in both feet. The important secondary characteristic is the backward rotation of the lateral elements of the carpus, tarsus and metapodials.

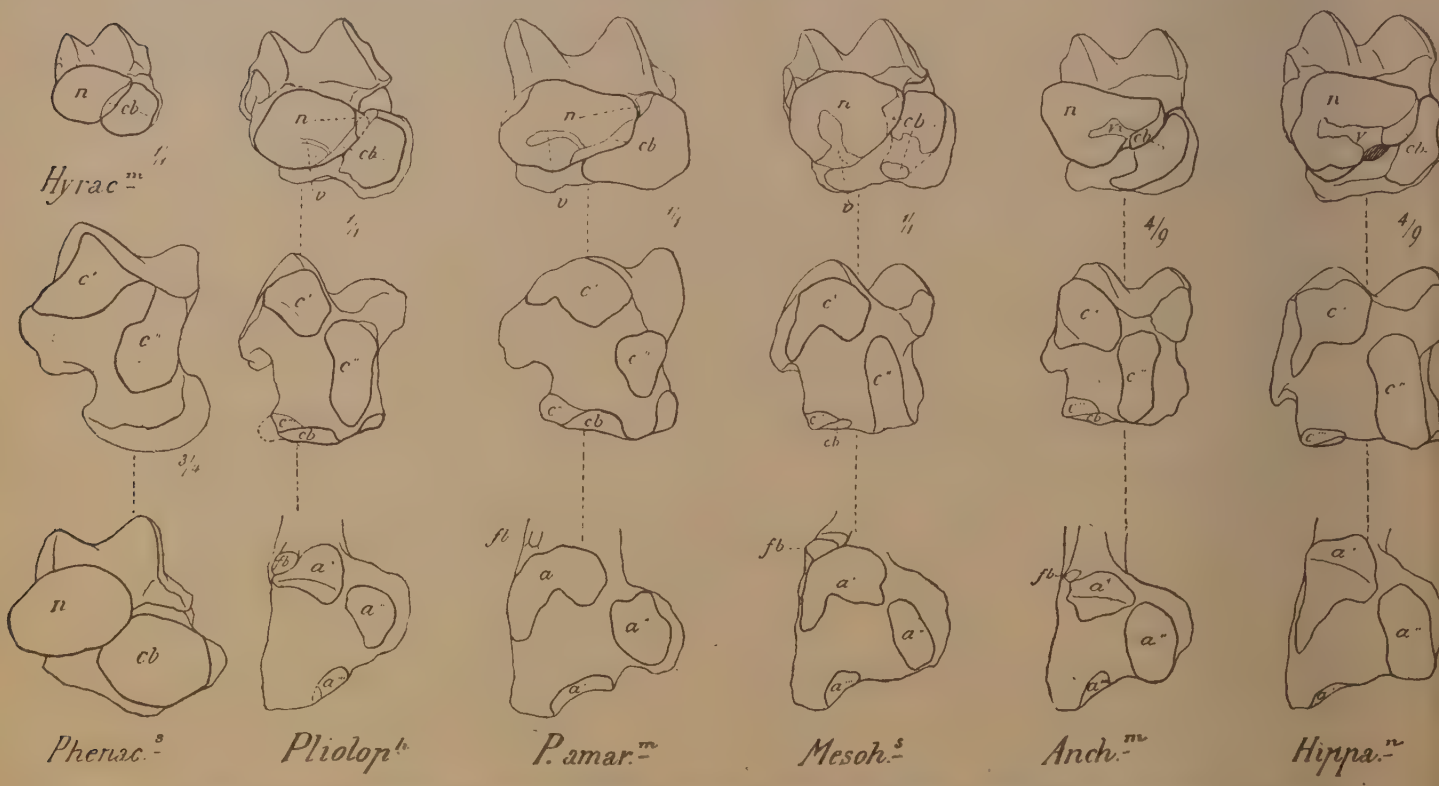
Carpus. The distinctive feature is the fact that the scaphoid early gains a somewhat broader foothold upon the magnum than the lunar has upon the unciform. This may be attributed to the early enlargement of mc. III, and ectal growth of the magnum. The lunar in the Eocene members retains subequal magnum and unciform facets (as in *Isectolophus*), but the carpus is laterally compressed. In the more recent forms the magnum, by its rapid growth, extends beneath the lunar, and the latter bone is thus brought back to its primitive position and rests in some species exclusively upon the magnum.

Hyracotherium and *Epihippus*. There is no marked difference between the carpus of *H. venticolum* and of *Epihippus*, excepting the advanced reduction of mc. v. In *Epihippus* (No. 10,405, Pl. XI, Fig. 4), the bones of the upper row are elongate. The scaphoid is directed backwards and rests distally upon the trapezoid and magnum, by subequal horizontal facets. The trapezium contact is very small. The lunar has the high and slender proportions seen in *Triplopus*, but the distal facets for the magnum and cuneiform are subequal and incline obliquely towards each other. The cuneiform is narrow and slender. The trapezium was evidently small, articulating with the scaphoid, trapezoid and mc. II. The trapezoid is much flattened. The magnum supports the lunar anteriorly and posteriorly. The unciform has an infero-lateral facet for the fifth metacarpal. The foot is practically tridactyl, mc. v being well retracted. The metacarpal articulation is of the alternating type.

The carpus of *Mesohippus* has never been described, nor that of any American species of *Anchitherium*. Referring to Kowalevsky's Memoir (Pl. II, Fig. 1*a*), we observe that the magnum extends beneath three-fourths of the lunar and the same proportion of the scaphoid, yet the metacarpal articulation is unaltered, mcs. II and

III forming "alternating" lateral contact with the magnum and unciform respectively. Kowalevsky, however, describes mc. III as spreading posteriorly beneath both the trapezoid and unciform. Thus the spreading of the magnum has already offset the progress of the more primitive displacement. A further step is seen in *Hipparion*.

If De Blainville's figures are correct (*G. equus*) the recent species, *E. caballus*, *E. Burchellii* and *E. asinus*, present three stages in the growth of the magnum beneath the lunar. In the former there is a broad contact between the lunar and unciform, much as in *Hipparion;* in the latter there is none at all, the lunar resting wholly upon the magnum, as in the primitive serial type.



DIAG. 10.—The evolution of the astragalar and calcaneal facets in the Hyracotherium-Hipparion series. *Phenacodus primævus*, Cope collection; *Hyracotherium venticolum*, Cope collection; *Pliolophus* (Orohippus) *major*, Princeton collection; *P.* (Triplopus) *amarorum*, Cope collection; *Mesohippus*, Princeton collection; *Anchitherium aurelianense*, Princeton collection; *Hipparion mediterraneum*, Princeton collection. The upper row represents the distal view of the astragalus and calcaneum; the middle row the posterior view of the astragalus; the lower row the anterior view of the calcaneum. *a'*, *a''*, *a'''*, ectal, sustentacular and inferior astragalo-calcaneal facets. *c'*, *c''*, *c'''*, ditto calcaneo-astragalar facets. *cb*, *fb*, *n*, cuboidal, fibular and navicular facets upon astragalus and calcaneum. *v*, fossa in the astragalo-navicular facet.

The reduction of the metacarpals is too familiar ground to require description here.

TARSUS. In the tarsus we fortunately have a complete series from *Hyracotherium* upwards. We begin with a tridactyl pes, although in the Wasatch species *H.*

validus (Marsh), there is a remnant of mt. I.* In the Eocene genera the separate elements are very narrow and vertically elongate; later the elements become broad and spreading. A primitive and persistent feature is the triangular cuboidal facet upon the astragalus (see Diag. 10). Another marked characteristic, early developed, is the reduction in size of the "inferior" astragalo-calcaneal facet and its wide separation from the "sustentacular." An important equine mark is the depression or fossa in the astragalo-navicular facets; this is a slight valley (*v*) in the Bridger species of Hyracotherium, which is variable in size but constantly increasing in the ascending series, terminating in an extensive fossa, in *Equus*.

There are, moreover, a number of minor tarsal features not always persistent but of great value in diagnosis; the three astragalo-calcaneal facets (*c'*, *c''*, *c'''*) are always separate, the trochlear groove is deep and sharp. In many Eocene species the navicular is inserted anteriorly between the cuboid and astragalus and thus develops a distinct calcaneal facet; this feature does not persist. In all Eocene specimens the calcaneum has a distinct pit for the fibula, in extreme flexion; this is usually facetted; it reappears in *Mesohippus* and sometimes persists in *Anchitherium*.†

The metatarsal articulations pass through three distinct types. In the Eocene genera we find the "alternating" type, in the Miocene the "plane serial," replaced later by the equine type.

Hyracotherium venticolum, *Pliolophus* and *Epihippus*, the Eocene genera, may be considered together. The first species from the Wind River is distinguished by the absence of the fossa in the astragalo-navicular facet (Cope, "Tert. Vert.," p. 645); this fossa is more or less distinct in five small and two large astragali (*P. pumilus* and *P. major*), in the Princeton collection, from the overlying Bridger, and very distinct in the *P.* (*Triplopus*) *amarorum* of the still more recent Washakie (Cope Coll.). The fibulo-calcaneal pit is present throughout, but is not invariably facetted. The naviculo-calcaneal facet is not present in *H. venticolum;* it appears in *P. major* and *P. amarorum*, but not apparently in *P. pumilus*. The highly compressed tridactyl character of the foot is retained throughout. The mts. III and IV articulate exclusively with the ectocuneiform and cuboid respectively. Mt. II articulates proximally with the mesocuneiform, also laterally with the ento- and ectocuneiforms. These relations are seen in *H. venticolum* and in *P. major*. In *P. amarorum*, mt. IV articulates laterally with the ectocuneiform. This species is also distinguished by the flattening of the navicular and cuneiforms and relative shortening of the cuboid.

* Marsh, Am. Jour. Sc. and Arts, Nov., 1876, p. 401.

† This facet is well marked in a calcaneum lately received in exchange from the Paris Museum, marked *A. aurelianense*, from Sansan. See Diag. 10.

Through the Eocene series, the lateral toes are not more rolled backwards than in *H. venticolum.*

In *Mesohippus*, the most marked development is seen: first, in the flattening of the cuneiforms; the entocuneiform is united with the mesocuneiform, but does not support mt. II; second, the tarso-metatarsal articulation is absolutely of the plane serial type; third, the lateral digits and corresponding tarsal elements are rolled backwards so that the outer elements are almost or quite in contact posteriorly, the cuboid touching the entocuneiform. The fibulo-calcaneal facet is always distinct. In the astragalus the ectal and sustentacular facets become nearly confluent; the astragalo-cuboidal facet is reduced to a small narrow triangle placed in front. The seven astragali examined (Princeton Coll., No. 10,255), apparently represent two species, in one of which, the smaller, the fossa upon the astragalo-navicular is faint; the larger species shows this fossa very distinctly (Prince. Coll., No. 10,256). This may, however, be not a specific but an age character.

The serial metatarsal articulation is an extremely interesting feature, when we compare this tarsus with that of *Hyracotherium* and *Pliolophus;* it precedes the growth of mt. III upon the cuboid in *Anchitherium*, an altogether different process from the lateral displacement seen in the above Eocene forms.

It is not necessary here to go over in detail the ground made familiar by the memoirs of Kowalevsky and Forsyth Major,* of the subsequent evolution of the pes; in fact, the material from American strata for such a purpose is not at present accessible.

3. The Hyrachyus, Triplopus, Hyracodon Series.

There is an intermingling of rhinocerotic and equine characteristics in the teeth and feet respectively of this series, which give it an especial interest and separate it widely from both the above stocks. It has nothing in common with the tapir series either in the structure of the teeth or feet, and unlike both the tapirine and equine lines, little is known of the sub-Bridger forms, and there is no parallel European phylum.

The general characteristics of the carpus and tarsus are the vertical elongation and lateral compression of the elements of each and the close union of the metapodials in some of the later forms, which, while tridactyl, renders the foot in some forms functionally monodactyl.

* According to Kowalevsky (Anchith., Pl. II, Fig. 20A . .), the ecto- and mesocuneiforms unite in *Anchitherium*, but are distinct in *Hipparion* (Anthracother., p. 164). According to Forsyth Major (Beit. z. Gesch. d. foss. Pferde. II Th., p. 62), the union of cu. 1 and 2 is the rule and of cu. 2 and 3 the rare exception.

CARPUS. In the tetradactyl *Hyrachyus* we find all the distinctive features of the carpus in this series are practically attained, these resulting from the great lateral displacement. The scaphoid has a very narrow trapezium facet and broad and decidedly oblique trapezoid facet; it rests broadly upon the magnum. In the lunar the radial facet is shallow; it is compressed below, with a narrow oblique anterior facet upon the magnum and broad subhorizontal unciform facet. The scaphoid and lunar thus rest principally upon the magnum and unciform. The cuneiform presents a small ulnar facet, this bone being rather slender. The trapezoid has a broad trapezium facet. The magnum has a narrow and oblique lunar facet. The unciform is a very characteristic bone since its vertical is greater than its transverse diameter. It nevertheless has a narrow facet for mc. v, which, according to Cope, is considerably the most slender.

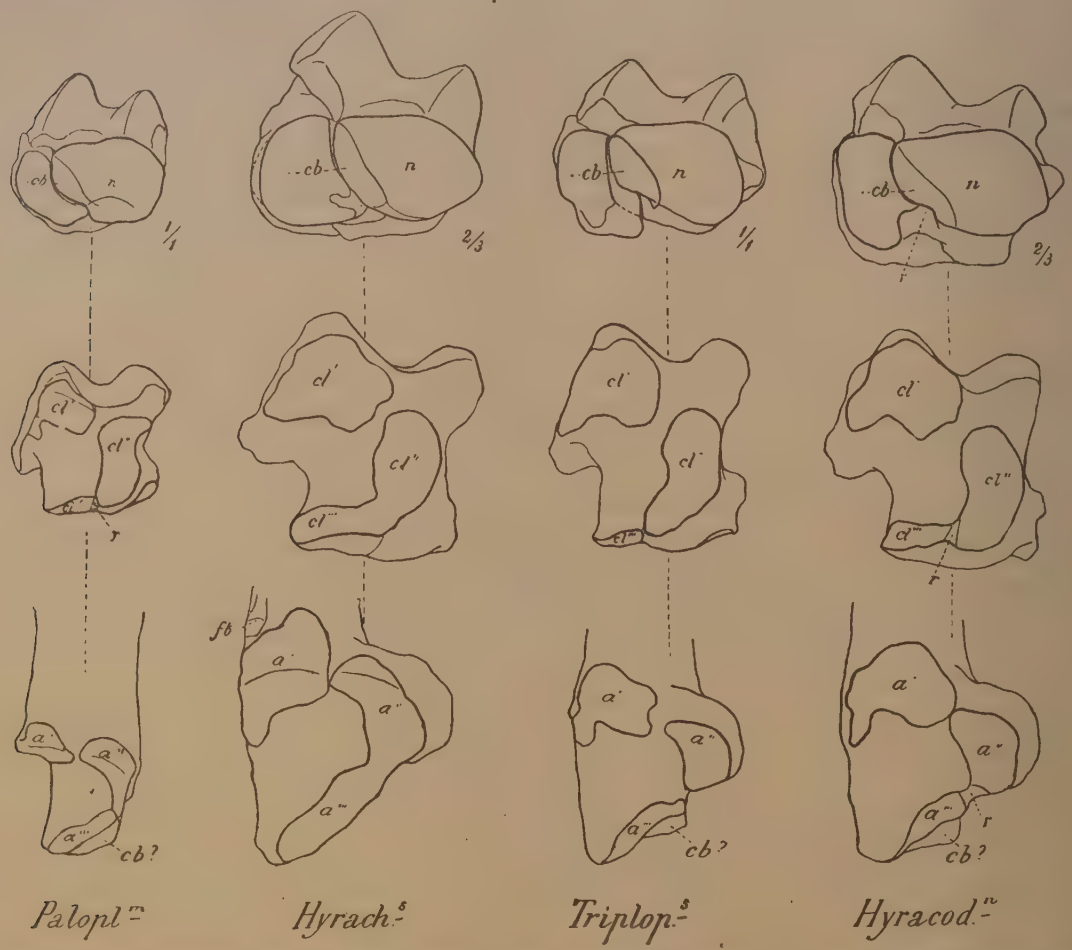
Taken altogether the vertical and transverse diameter of the carpus is about the same.

In *Triplopus* the vertical diameter of the carpus is slightly greater than the transverse, the metapodials and carpals are somewhat rolled backwards so that the anterior face of the manus is strongly convex. Every feature in which the manus departs from that of *Hyrachyus* is in the direction of greater elongation and lateral displacement. The scaphoid is narrow and has a very oblique trapezoid facet; its main weight descends upon the magnum. (The small trapezium and the trapezoid are missing in the Princeton collection.) The lunar rests entirely upon the unciform, its contact with the magnum anteriorly is by a vertical facet, variable, never in the nature of support, sometimes entirely wanting. The cuneiform, like the scaphoid, is rotated backwards. Judging by the facets upon the mc. II and the scaphoid, the trapezoid was laterally compressed. The vertical diameter of the unciform exceeds the transverse; it still bears a considerable mc. v facet.

In *Hyracodon*, the carpus repeats the structure of *Triplopus* upon a larger scale. The proportions of the metapodials are approximately the same; the proximal portion of mc. v persists but is very much reduced in size. The magnum has relatively increased in size, but still has a very limited contact with the lunar anteriorly. The trapezium is small and has no contact with mc. II. The vertical diameter of the unciform much exceeds the transverse; the cuneiform is also high and very narrow. The degree of backward rotation of the lateral elements evidently varies in the different species.

TARSUS. In the astragalo-cuboidal articulation, in the number and disposition of the digits and in the shape of the terminal phalanges, this series closely approaches the equine series, and, in some cases, can be distinguished only by very careful

examination.* The diagnostic features of the members of the *Hyrachyus* series are the relatively flat or obtuse keels of the trochlea and the frequent confluence of the sustentacular and inferior calcaneal facets of the astragalus. The same facets are invariably separate in the equine series, beginning with *Hyracotherium*. The *Hyrachyus* calcaneum occasionally shows a pit for the fibula, but this does not bear a facet as in nearly all the equine series.



DIAG. 11.—The astragalar and calcaneal facets in the Hyrachyus-Hyracodon series. *Paloplotherium minus*, Princeton collection. *Hyrachyus* (sp. indet.), Princeton collection. *Triplopus obliquidens*, Princeton collection. *Hyracodon major*, Princeton collection.

Hyrachyus (No. 10,199, Princeton Coll.). The cuboidal contact with the astragalus expands posteriorly, but is very narrow anteriorly in some species (*H. princeps*), bringing the navicular into contact with the calcaneum precisely as in some species of *Hyracotherium* (*Triplopus amarorum*); as above stated there are

* I have referred the *Triplopus amarorum* of Cope, from the Washakie beds (uppermost Bridger), to the equine series.

but two calcaneal facets, the inferior and sustentacular being confluent; the variants in these facets, seen by comparing a large number of astragali, are found to be: (1) The greater or less union of these facets, looking towards a more primitive form in which they were probably separate; (2) the presence of a small ridge, *r*, at the point of junction, looking towards the well-developed ridge in the later forms (*Hyracodon*). The calcaneum presents a very long slender tuber, three astragalar facets and an extremely narrow and deep distal cuboidal facet. The cuboid is correspondingly narrow and elongate, in the small species compressed in the middle, and with no trace of a facet for mt. v and little or no contact inferiorly with mt. III. The ectocuneiform is elevated and has a lateral facet for mt. II. The mesocuneiform is small; according to Cope, "the entocuneiform is large, flat and posterior in position." *

Triplopus (No. 10,397, Prince. Coll.). Although the pes as a whole is very narrow and slender, the trochlea is much shallower than in the equine series (Diag. 11, Plate XI, Fig. 9); the cuboidal contact narrows anteriorly to a point, but the navicular is excluded from contact with the calcaneum; the inferior and sustentacular facets are either confluent or closely approximated and vary in the development of the ridge (*r*). The calcaneum has a narrow and oblique cuboidal facet, a long laterally compressed tuber and narrow sustentaculum; there is no trace of a fibular facet. The cuboid is compressed in the middle as in *Hyrachyus*, elongate and with a relatively small distal facet for mt. IV, indicating that this digit was much reduced. The navicular is very deep and laterally compressed. The mesocuneiform and entocuneiform are wanting in the Princeton collection. The ectocuneiform articulates with mt. III only, indicating that the metapodial articulation was absolutely plane; the lateral toes were rotated backwards precisely as in *Anchitherium*.

Hyracodon† (No. 10,397, Princeton Coll.). In this genus we find an exact repetition of the tarsus of *Hyrachyus* in considerably heavier form than in *Triplopus*, and with few modifications. The astragalus has the same limited cuboidal contact; the three calcaneal facets are nearly confluent, the "sustentacular" and "inferior" are fully so and a sharp ridge at their point of junction interlocks with a correspond-

* Tertiary Vertebrata, p. 659; *H. eximius*.

† On the Skull o the Eocene Rhinoceros, Orthocynodon, and the Relation of this Genus to other Members of the Group. E. M. Museum Bull. No. 3, 1883, p. 17, "Hyracodon was a slender, long-limbed and slightly built animal with a long neck and delicate head. Its proportions were those of a Horse rather than of a Rhinoceros." p. 20, "In short, it was a cursorial Rhinoceros, and all its modifications went towards adapting it to swift locomotion * * * One can hardly help believing that had this line persisted, it would have resulted in a unidigital type, just as the tridactyl *Anchitherium* of the Miocene has terminated in the Horse."—W. B. Scott.

ing depression in the calcaneum. The navicular is shallower than in *Triplopus*, resembling closely that of *Hyrachyus*, and showing facets for three cuneiforms. The cuboid is elongate and compressed in the centre as in the above forms, and articulates distally with mt. IV only. The ectocuneiform has a lateral facet inferiorly for mt. II (unlike *Triplopus*), thus reverting to *Hyrachyus*. The mesocuneiform is correspondingly shortened, while the entocuneiform is flattened and rotated backwards as in *Hyrachyus* (No. 10,005, Princeton Coll.).

In the pes of *Paloplotherium* we have a striking resemblance to that of *Triplopus*, and of the Eocene horses except for the greater reduction of the lateral toes. This is simply an example of parallelism, for the teeth* show no affinity to either of these lines. The lateral digits are as far reduced as those of *Hipparion*.†

4. The Rhinoceros Series.

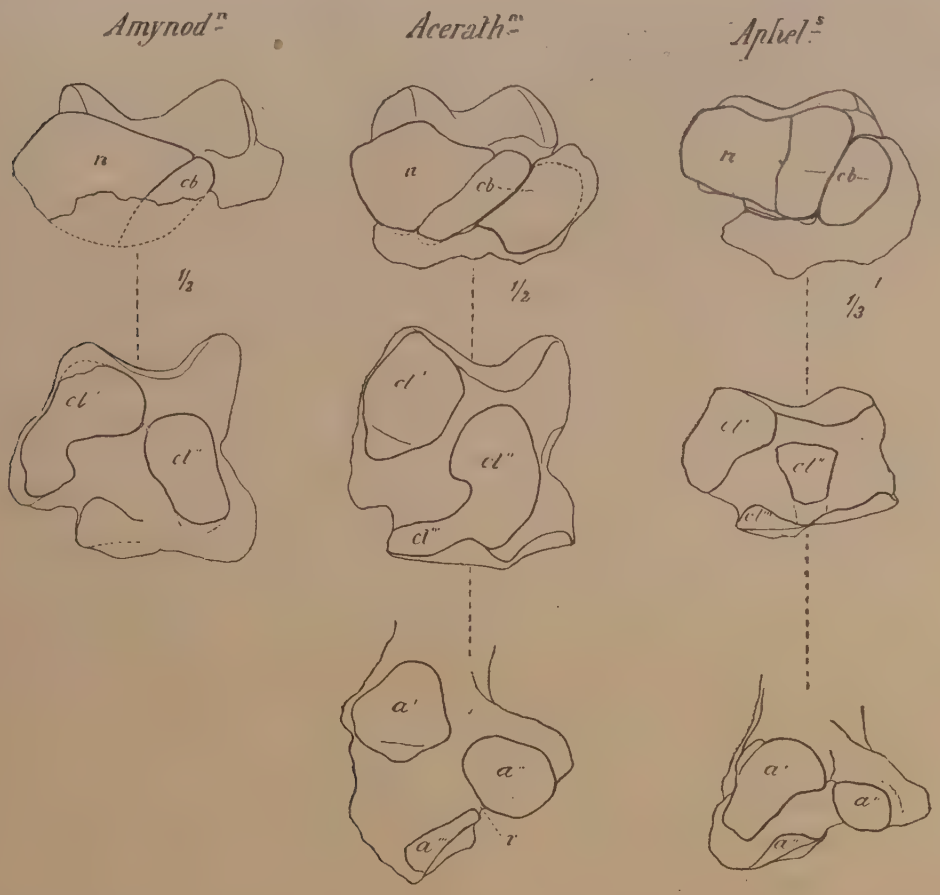
A.—Aceratherium. *B.—Aphelops.*

The comparison of the carpus and tarsus in the hornless rhinoceroses of the American Miocene shows a wide divergence between the *Aceratherium* (lowermost Miocene) and *Aphelops* (uppermost Miocene) series. The *Aceratherium* feet are extremely elongate, with the toes closely compressed, reminding one strongly of the feet of the pseudo-rhinoceros, *Hyracodon*, from the same beds. The more recent *Aphelops* is generally considered a successor, but shows a widely different type of

* Schlosser (Beiträge z. Stammesg. d. Huft.) points out the anomalous mixture of primitive and secondary characters in this genus. The premolars are reduced in number, $\frac{3}{3}$, but simpler than the molars, while the molar crowns are more advanced than those of *Palæotherium*, showing cement.

† Lydekker (Cat. Foss. Mamm., Part IV, p. 16) follows Flower in uniting *Paloplotherium minus* and *Palæotherium* (see Cat. Roy. Coll. Surg., Part II, Mammalia, p. 390). The ground assigned is the presence of a "complete transition between the two types." On precisely similar principles we should unite *Hyracotherium venticolum* with *Mesohippus*; nay more, because the American genera undoubtedly belong to one line of descent, whereas the two French genera, judging by the extremities and teeth, belong to different lines. Further, is nomenclature actually simplified when a genus is made so comprehensive as to extend over long geological and wide geographical areas, embracing such a variety of forms that it becomes necessary (*vide Rhinoceros* and *Palæotherium, opera citata*) to arrange the species into groups? We think not. Genera can no longer be defined in the Linnæan sense. Lamarck, a century ago, anticipated the difficulties which would arise when the gaps between Cuvier's and Buffon's genera were filled up. The range of variation which should be included in a single genus is largely a matter of arbitrary judgment. Never has the problem been more perplexing than among the unbroken series found in the western Tertiaries. The writers, for the present, have adopted the rule long since employed by Marsh and Cope, viz, differences of degree, size, proportion, may be taken as specific; differences of kind (in the number of teeth or digits) or of actual form (*e. g.*, the assumption of the molar pattern by the premolars), may be taken as generic. This rule, when applied, for example, to the horse series, is found to work admirably—each of the subdivisions of the Eocene is characterized by a genus—and by a number of species varying in the direction of the lower and higher forms. Judging by the thickness of the strata, these subdivisions represent long periods of time.

foot, which is highly "modernized." The relations of these genera to the European forms is somewhat uncertain, so that the following observations apply especially to the above American genera.



Diag. 12.—The astragalar and calcaneal facets in *Amynodon*, *Aceratherium* and *Aphelops*. All species indeterminate.

A.—Aceratherium (Coll. Mus. Comp. Zoöl.). The general characteristics of the feet are lateral compression and vertical elongation of the carpal and tarsal elements and the elongate character of the metapodials. The *carpus* shows the same degree of lateral displacement seen in the tapir. The scaphoid is subquadrate, resting by a broad and slightly oblique facet upon the trapezoid. The lunar has a broad unciform facet, but retains a small horizontal facet upon the unciform. The cuneiform extends widely backwards. In the second row, the trapezoid supports mc. II; the magnum is a stout bone, subquadrate anteriorly, projecting beneath the lunar posteriorly with the incipient stout pivotal peg, which is so largely developed in *Aphelops*. The third metacarpal is less enlarged than in *Aphelops;* the second and

fourth are slightly smaller; the unciform facet indicates that mc. v (missing in this collection) had about the same relative size as in the tapir.

The *tarsus*. The astragalus rests by a rather narrow facet upon the cuboid; this facet is equally broad posteriorly and anteriorly, as contrasted with the *Hyracodon* and equine series on the one hand and the *Palæosyops* series on the other. The arrangement of the calcaneal facets is shown in Diag. 12. The calcaneum has a long slender tuber expanding into a knob. The cuboid has its vertical diameter exceeding the transverse, unlike all the more recent rhinoceroses. The articulation of the third and fourth metatarsals with the ectocuneiform and cuboid is of the "plane serial" type, but mt. II abuts against the ectocuneiform.

B.—In *Aphelops* the carpus and tarsus are very broad and spreading and show the extreme of diplarthrism. In both, the metapodial articulation is of the primitive "alternating" type. The toes spread widely, being reduced to three in each foot.

Carpus (see Diagram 8). The scaphoid is very broad, covering the whole anterior surface of the magnum, while the lunar rests anteriorly upon the unciform alone, posteriorly upon the pivotal process of the magnum. A remarkable feature of this bone is its unique articulation with the magnum hook posteriorly. The great development of the middle toe and relatively increased size of the magnum, renders the scapho-magnum surface broader than the lunar-unciform. Facets for the trapezium are seen upon mc. II and the trapezoid. The trapezoid and magnum facets of the scaphoid are subequal and horizontal, directly transmitting the weight. Mc. II abuts proximally against the magnum; mc. III is much larger than the lateral metacarpals and has a very broad unciform facet. There is no trace of a facet for mc. V.

This type of carpus is precisely similar to that of *R. unicornis* and *R. bicornis*, as figured by De Blainville.

Tarsus. The astragalus is broad and low with a shallow trochlea, and broad cuboidal facet, which is as large as that upon the calcaneum; a characteristic feature is the ental extension beyond the three distinct calcaneal facets. The calcaneum is characterized by a short tuber calcis and very slender sustentaculum; the three astragalar facets are separate and rather small. The transverse diameter of the cuboid is greater than the vertical. The mesocuneiform is much reduced. The mts. II and IV have lateral facets upon the ectocuneiform and cuboid respectively of the "alternating" type.

This type of tarsus is found in *R. unicornis* and *R. bicornis*, which are, however, less broad and spreading. These recent genera differ from *Aphelops* and resemble *Aceratherium* in the mode of metapodial articulation, the mt. III not possessing a cuboidal facet. In fact the cuboidal facet upon mt. III in *Aphelops* is apparently unique.

5. The Palæosyops, Diplacodon, Titanotherium Series.

The general characteristics of the feet in this series are the following: The carpus is broad and flat, and the lateral displacement is limited; there are four spreading and fully functional toes. In the pes on the other hand the cuboid extends rapidly beneath the astragalus, the lateral displacement being very rapid. The calcaneum has a fibular facet. The terminal phalanges are flat and spreading distally.

Carpus. In each of the carpal elements in the genera of this series we invariably find (excepting in the lunar of some of the Bridger species) that the transverse diameter exceeds the vertical, in a ratio increasing as we ascend. The lunar can always be recognized by its nearly subequal magnum and unciform facets, and the unciform by its broad facet for mc. v.

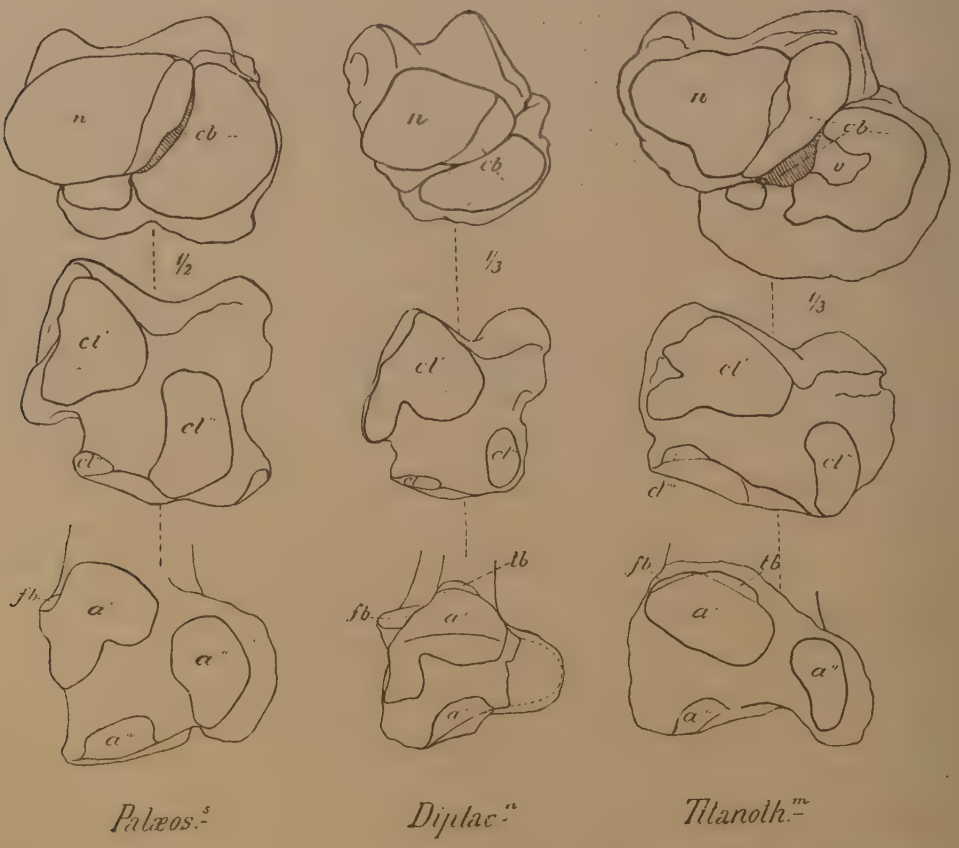
Palæosyops (No. 10,013, Princeton Coll.). There are two distinct types of feet which may be here referred to *Palæosyops*, but cannot with certainty be determined specifically. One belongs to a large and heavy form with short, stout digits (possibly *P. major* Leidy, or *P. validens* Cope), the other to a lighter, more graceful animal with long, rather slender digits (possibly *P. paludosus* Leidy). There is a third type, intermediate in size, between the above, but showing the heavy proportions of the large type. The scaphoid has subequal magnum and trapezoid facets, and, in its somewhat oblique position, transmits its weight equally to both elements. The lunar has a deep radial facet; it is wedge-shaped inferiorly; the direction of its magnum and unciform facet varies in the two types from a sharper to a more obtuse angle; thus, in the lighter forms the magnum facet is small and strongly inclined, while in the heavy forms the same facet is larger and more horizontal; corresponding variations are found in the superior facets of the magnum; taken together they determine the degree of transmission of the weight through the magnum and unciform respectively. The trapezium sustains no direct pressure, but articulates with the scaphoid, trapezoid and mc. II. The trapezoid receives half the weight of the scaphoid. The unciform is very broad, resting inferiorly upon the mc. III–V. The variations in the metapodials between the heavy and slender types are strongly marked.

Diplacodon. The scaphoid, lunar and cuneiform of a carpus have been collected from the Uinta which agree so closely with the corresponding elements in the slender type of *Palæosyops* above described, that they require no further description. They belong either to a small species of *Diplacodon*, much smaller than the *D. elatus* of Marsh, or to a persistent species of *Palæosyops*. The only departure from the above

type is in the slightly increased massiveness, which might well represent individual variation.

The metapodials of a right manus of *Diplacodon* are well preserved; they are long, relatively slender, and spreading, interlocking closely proximally and keeled upon the posterior distal faces.

Titanotherium (Coll. Mus. Comp. Zoöl. of Cambridge). The growth of the lunar and magnum are the distinctive features of this carpus. The l u n a r presents two distal subequal facets for the magnum and unciform respectively. The c u n e i f o r m is relatively somewhat reduced, while the scaphoid is enlarged and rests by two nearly horizontal facets upon the trapezoid and magnum.



DIAG. 13.—The astragalar and calcaneal facets in the Palæosyops-Titanotherium series. *Palæosyops major*, Princeton collection; *Diplacodon ? elatus*, Princeton collection; *Titanotherium* (sp. indet.), Princeton collection.

Tarsus. The special characteristics of the tarsus, in addition to those above mentioned, are the wider separation of the three astragalo-calcaneal facets and reduction of the inferior facet; the astragalo-cuboid facet is an elongated triangle, broad in front, narrowing posteriorly; the astragalar trochlea extends backwards upon the

calcaneum so that the tibia articulates with the latter in *Diplacodon* and *Titanotherium*. The fibulo-calcaneal facet in *Palæosyops* increases to a considerable size in *Titanotherium*. The cuboid and other elements of the second row of tarsals are rather broad. The metatarsal articulation is secondarily of the alternating type.

Palæosyops. The astragalo-calcaneal facets together present a broad surface for the cuboid and navicular, between the bones is a gap which is bridged by the cuboid. The astragalo-cuboid facet is slightly narrower behind than in front. The calcaneum has a small fibular facet, and distally presents a broad oval face for the cuboid. The cuboid is subquadrate in proportion, much as in the tapir series, and presents a sharply defined astragalar facet; distally it rests upon mt. IV, and presents a variable facet anteriorly for mt. III. The ectocuneiform is also subquadrate anteriorly and not only supports mt. III, but has a broad facet laterally for mt. II. The mesocuneiform is thus somewhat flattened. The entocuneiform is not preserved in the Princeton collection.

Diplacodon. The tarsus (Plate VIII) is represented merely by an astragalus and calcaneum which are somewhat crushed, but nevertheless present important transition characters. Thus the fibulo-calcaneal facet is much larger; the tibia extends from the astragalar trochlea upon the calcaneum; the tuber calcis is very long and laterally compressed. In the astragalus the trochlea is deep; the three calcaneum facets are much reduced; the cuboidal facet is broader anteriorly and narrower posteriorly. There is thus an intermingling of *Palæosyops* and *Titanotherium* characteristics. Viewed together, however, these bones are elevated and laterally compressed, indicating a high and rather narrow pes. With the metacarpals above described, we may infer that *Diplacodon* had gained greatly in height upon *Palæosyops* without having acquired any of the massive proportions of *Titanotherium*.

Titanotherium. The tarsus is very broad and flat, the metapodials spreading widely. In the astragalus the trochlea is shallow, the inferior calcaneal facet is greatly reduced and is confluent with the cuboidal facet; the latter is broad in front and tapers to a point posteriorly. The gap between the astragalus and calcaneum, observed in *Palæosyops*, is here greatly enlarged, the cuboidal contact with both astragalus and calcaneum is interrupted by slight surface depressions, analogous to the "navicular fossa" in the horse. The tibia and fibula both have calcaneal facets. By the broadening of the cuboid the navicular is greatly reduced. The cuneiforms are flattened. Mt. III has a broad contact with the cuboid, and mt. II with the ectocuneiform.

In a general review of the above series, we observe practically the same type of intercarpal articulations in all tetradactyl and tridactyl forms irrespective of the geological period to which they belong. Thus the tapir manus is a persistent example of a type developed independently, at different periods, in *Hyracotherium*, *Hyrachyus*, *Aceratherium* and *Palæosyops*. The tridactyl rhinoceros, with *Triplopus*, *Hyracodon* and *Palæotherium* present another type. The significance of this parallelism is discussed in another section.

In the tarsus we find a striking analogy between the equine and Hyracodon series. In another series may be grouped all the remaining Perissodactyla.

There is actual disproof of Kowalevsky's generalization as to the bearing of the spreading of the metapodials upon the survival of the fittest, in the non-spreading of the metapodials at an important stage in the development of the horse series (see p. 546). In fact we can trace no connection between certain foot structures and survival in perissodactyl phyla. We must either with Schlosser (*op. cit.*, p. 121) regard the inadaptation of the teeth to the changes in the character of the food as the cause of extinction, or rather look at the organization as a whole in its relations to the changes both in food and to the rapid increase of Carnivora and competing Herbivora.

IV. THE CLASSIFICATION OF THE UNGULATES.

This detailed comparison certainly supports in a measure Rütimeyer's* designation of the foot bones as a "verschiebare mosaik," and raises the question as to how far these articulations can be employed in classification. With all the direct contradictions in Cope's system urged by Rütimeyer and others, which are here pointed out, there still remains the universal principle that in every step of transition from the primitive plantigrade foot towards digitigradism, some form of displacement from the serial order, or interlocking of parts, took place. This proceeded not at random, but along certain definite lines, conforming in general to the succession in geological time and large existing subdivisions of the Ungulata, and of great value as expressing their relations to each other and to the primitive stock. We cannot, therefore, as the distinguished Swiss palæontologist advises us (p. 18), rest content with the lines drawn by Cuvier and Owen, because the derivation from the plantigrade taxeopod ungulate was not recognized in their system, and the underlying principle of Cope's system, since adopted by Marsh, and many of the younger school of palæontologists, rests upon a secure basis of fact. The real problem is, therefore, to ex-

* Ueber einige Beziehungen z. d. Säugethierstämmen alter u. neuer Welt. Zurich, 1888.

clude the variable elements, and ascertain those which are constant in the ordinal divisions; of course, no sharp lines of division, such as were apparent to the older naturalists, exist as we descend in the mammalian series.

First: We observe that while the metapodials play an important part in the displacement, the separate metapodial articulations are not available for taxonomic purposes in the larger divisions above the Protungulata. In the carpus there are practically but two types of articulation, the "serial" in the absolutely primitive and in some later forms, and the "alternating" in all but the highly specialized "adaptively reduced" Artiodactyla. There are no stages which are of more than family value.* In the tarsus the primitive serial type is retained almost unmodified in the Proboscidia and Hyracoidea, and in the early equine and Hyrachyus series it passes into the "plane serial," and into the alternating in the Palæosyops series.† The remaining Diplarthra show great variation in the mode of metatarsal articulation, so that there is no single type characteristic of all the genera of the *Tapiridæ* or *Rhinocerotidæ; Aphelops*, *Aceratherium*, *Atelodus* and *Rhinoceros*, each has a different type of metatarsal articulation.

Second: In the tarsus Prof. Cope's definitions and principles will not strictly apply, first, because the astragalus extends over the cuboid in some of the earliest and not in some of the more recent Mammalia, and this displacement is thus by no means distinctive as between the lower and higher types. The astragalus extends upon the cuboid in one or more members of the "taxeopod" Hyracoidea (*Dendrohyrax*) and Condylartha (*Periptychus*), and in all the Amblypoda, to a much greater extent than in many of the diplarthrous Perissodactyla (see the Equus, Hyrachyus, Paloplotherium series, p. 548).

As Rütimeyer points out, there is no parallelism between the diplarthrism of the fore and hind feet—diplarthry may be rapidly developed in one while taxeopody persists in the other. This arises from the fact that the mechanical problems of adaptation to the unguligrade position are dissimilar in the fore and hind feet owing to the difference both in the arrangement of the bones and in the motions. Among the Hyracoidea, *Hyrax* is a taxeopod in both feet, while *Dendrohyrax* has a taxeopod manus and diplarthrous pes. In the Proboscidia the manus is nearly serial, sometimes completely so, while the pes is invariably diplarthrous, although well distinguished

* Kowalevsky's "adaptive reduction" arises independently in the Bunodonta and Selenodonta.

† There are some other marked illustrations of the variable nature of the podial articulations. The confluence of one or the other of the three astragalo-calcaneal facets is subject to specific variations; compare *R. incisivus* and *R. leptorhinus* (De Blainville, Osteogr.). Compare the astragalo-cuboidal facets in *Tapirus americanus* and *T. indicus*. The lunar magnum facet differs widely in *Equus burchelii, caballus* and *asinus*.

by the movement of the navicular above the cuboid. Cope has himself recognized the difficulty arising in the Amblypoda from the union of limited diplarthrism in the carpus with extreme diplarthrism in the tarsus. In *Macrauchenia* we find a peculiar displacement in the carpus and no astragalo-cuboidal contact in the tarsus.

The fibulo-calcaneal facet may be regarded as a secondary character, since it is developed independently in so many phyla—as a trochlear joint in *Meniscotherium*, *Macrauchenia*, the Artiodactyla; as a supporting facet in the Proboscidia, Titanotheridæ and Hyracotheridæ. It cannot be employed in ordinal classification (*vs.* Cope, Tert. Vert., p. 378).

Third: The definitions based upon the carpal series cannot be availed of strictly as employed by Cope.* For (1) in some of the Amblypoda (*Uintatherium*) the scaphoid has a broad posterior facet upon the magnum, although of less extent than the lunar unciform facet. (2) In the Proboscidia the lunar frequently rests upon the trapezoid, and sometimes upon both the trapezoid and unciform. (3) In Macrauchenia the lunar is entirely excluded from the unciform, the cuneiform resting upon the magnum.

A comparison of the entire evolution of the carpus and of the tarsus shows that the former, while more complex, is subject to more definite laws, and is therefore more available for purposes of classification. The carpal characters are constant and distinctive, but not exactly as interpreted by Prof. Cope†—we must look at the manus as a whole, including the metacarpals. The tarsal displacements can be employed for subsidiary definition only. It has thus been shown that Cope's whole system breaks down if we attempt to establish a parallel between the evolution of the carpus and the tarsus in relation to displacement.

With these limitations the principle of classification of the ungulates by foot structure loses the universal application claimed for it by Cope, but is by no means invalidated to the extent held by Rütimeyer.‡ Giving the first rank to the characters of the manus, and second to those of the pes, the following modifi-

* Tertiary Vertebrata, p. 376.

† Tertiary Vertebrata, p. 377. "In the first place I find the diversity in the structure of the carpus to be greater in the relations of the magnum and scaphoides than in the relations between the unciform and the lunar. In other words the trapezoides and magnum are more variable in their proportions than is the cuneiform. * * * I therefore view the relations of these bones as more characteristic." In the succeeding section, V, this view is shown to be untenable.

‡ *Op cit.*, p. 18.

cation of Cope's table is proposed; several subordinal characters being omitted for brevity:

A.—a. Carpals serial.
I. TAXEOPODA.
1. Primitive. Protungulata.
c. Plantigrade.
e. Tarsals serial.
b. Metapodials serial.
2. Intermediate. Condylarthra.
c. Subdigitigrade.
e. Tarsals serial.
b. Metapodials displaced.
3. Recent. Hyracoidea.
c. Plantigrade.
e. Tarsals serial or displaced.
b. Metapodials displaced.

B.—a. Displacement of first upon second row of carpals not uniform.
b. Metapodials displaced.
II. AMBLYPODA.
c. Semi-plantigrade, plantigrade.
d. Lunar upon cuneiform.
e. Astragalus upon cuboid.
III. PROBOSCIDIA.
c. Semi-plantigrade.
d. Carpals serial, or lunar upon trapezoid.
e. Astragalus and navicular upon cuboid.
IV. (MACRAUCHENIA.)
c. Digitigrade.
d. Scaphoid and unciform upon magnum.
e. Tarsals serial.

*C.—a. Displacement of first upon second row of carpals uniform.**
b. Metapodials displaced.
c. Digitigrade to unguligrade.
e. Tarsals more or less displaced.
V. DIPLARTHRA.
1. Perissodactyla.
f. Mesaxonic.
c. Carpal displacement extreme in reduced forms.
e. Astragalo-cuboidal facet flat.
2. Artiodactyla.
f. Paraxonic.
a. Carpal displacement limited in reduced forms.
e. Astragalo-cuboidal facet ginglymoid.

The position of the Toxodontia and of *Macrauchenia* is doubtful.

The three subdivisions above employed (A, B, C) bring out what appears to be a fundamental distinction between Orders II, III, IV and V. The significance of the diverse carpal displacement in the Artiodactyla and Perissodactyla is shown in the next section.

V. THE PRINCIPLES OF DISPLACEMENT.

The evolution of the manus and pes of the ungulates included the following processes: (1) Elevation from the plantigrade to the digitigrade position; (2) growth of certain elements and reduction of others, including the loss of lateral parts; (3) displacement of the elements of the podium and metapodium from the primitive serial arrangement; (4) coalescence of parts primitively distinct. All these processes interacted upon each other, and so far as they can be distinguished, took place, for the most part, in the order named. That is, elevation usually preceded the metatrophic or unequal growth of parts and the elongation or vertical growth of the metapodial elements involved the mutual displacement or interlocking of the podials and metapodials. The effects of these processes were in the nature of adaptations correlated with changes in the entire body which were induced by the habitat, manner of feeding, character of the ground, necessity of speed both in ranging for

*See this Memoir, p. 541. The scapho-magnum = lunar-cuneiform facet.

food and escaping enemies. Kowalevsky* and Rütimeyer† have treated these factors very fully. Then there were the changes in the movement of the limbs with reference to the axis of the body; for example, in the evolution of the horses Kowalevsky has directed attention to the atrophy of muscles which rotated the fore limb, resulting finally in a direct fore and aft motion. Another factor was the transmission of the weight unequally through the bones of the lower leg, as one or other of these elements grew or became reduced. Finally there were the influences which the reduction of the lateral digits in the artiodactyl and perissodactyl series exerted upon the central digits and upon the podial elements by modifying the principal lines of "impact and strain."

The Manus.

It has been shown that the modifications of the manus are more complex and yet proceed along more definite lines than those in the pes, and in spite of the great variety of influences exerted we can discover certain fixed laws of modification.

1. *Relations of growth, reduction and displacement.* As displacement changes the vertical relations of the three rows of podial elements to each other, it follows that there must be concomitant growth in some elements and reduction in others, otherwise some of the lateral parts would be left without support. That the displacement of an element, however, involves a principle distinct from mere growth and is an actual shifting or "rotation" process, although not to the degree maintained by Cope,‡ is shown by a number of facts. First, as to the chief factors in each process. Growth is more directly brought about by vertical pressure, as seen in the magnum of the Equidæ; and displacement, by lateral strain, as seen in the shifting of the metapodials to the ectal side of the carpus. Displacement is apparently arrested in such a series as *Hyracotherium*, where the fore limb acquired an orthal movement and, the entire vertical pressure passing through the median toe, the growth of the magnum counteracted the incipient displacement of the lunar upon the unciform. We cannot explain the lateral facets of metacarpals II and III in the pentadactyl Amblypoda and Proboscidia as due merely to growth of the elements displaced, for the digits are strikingly equal in size; they both extend to the ectal side, and what mc. III gains upon the unciform it apparently surrenders to mc. II upon the magnum. Finally, there is every reason to agree with Kowalevsky that the reduc-

* Monogr. der G. Anthracotherium, Palæontographica, Bd. XXII, 1873, pp. 161–5.

† *Op. cit.*, pp. 17–24.

‡ The Perissodactyla. American Naturalist, 1887, p. 986.

tion of the lateral digits in the ungulate foot is largely the direct result of elevation to the unguligrade position which rendered useless the shorter lateral digits of the plantigrade foot. Yet every step in reduction of the toes influenced the growth and displacement of the more proximal elements.

It can be demonstrated that these three processes were concomitant, and while resulting directly or indirectly from the same causes, were not affected in the same degree by them. The problem may be expressed in this way: What were the principal factors in each of the above processes, and how did these processes interact.

2. *Theories of modification.* As Kowalevsky was unaware of the primitive serial arrangement of the podial elements, his studies were chiefly directed to the phenomena of growth in the metapodials and the manner in which in the adaptive and inadaptive artiodactyls and in the perissodactyls the second and third metacarpals spread from their respective carpals to the adjacent elements.*

Ryder† later pointed out the effect of impacts and strains upon the phenomena of reduction of the digits.

Cope,‡ the first to recognize the common development of the ungulate foot from a primitive serial type, was also the first to advance a "displacement" theory: "As the foot is descending towards the ground it is with the distal part of the leg rotated from within outwards. The rotation of the foot is promptly arrested at the moment of its contact with the ground, and the effect of this arrest is to produce a torsion of the leg, and a pressure from within outwards of the proximal or moving element of each articulation against the distal or fixed element."

An adequate theory for the displacement phenomena must, however, explain the shifting of the metacarpals and metatarsals, as well as that which takes place between the two rows of carpals and tarsals. The latter always takes place (excepting in the Proboscidia) in the same direction. Prof. Cope's theory has therefore to meet the apparently fatal objection that the arrest of rotation to the ectal side would be first felt at the junction of the metapodials and podials, and if it were of the character he describes, would continually tend to separate these joints and displace them to the ental side, whereas we find them provided with facets to resist pressure towards the ectal side.

It is a significant fact, recently pointed out by Weithofer,§ that in all ungulates in which the radius is larger than the ulna, the proximal row of carpals is displaced

* Monog. der Gatt. Anthracotherium, 1873, p. 142.

† On the Laws of Digital Reduction. American Naturalist, 1877, p. 603.

‡ The Perissodactyla. American Naturalist, 1887, p. 986.

§ Einige Bemerkungen über den Carpus der Proboscidier. K. Ant. Weithofer, Morph. Jahrb., 1888, p. 508.

to the ectal or ulnar side of the distal row; in the one order (Proboscidia) in which the ulna is the larger bone, the proximal row is moved, if at all, to the ental or radial side.

3. *Relation of the size of the radius and ulna to displacement.* It thus appears probable that the transmission of the main body weight through the ectal or ental side has caused displacement between the first and second row of podial elements respectively to the ental or ectal side. But this is clearly not the only factor; if it were, this displacement should be proportional in the Diplarthra to the enlargement of the tibia and radius respectively; this is certainly not the case either in the carpus or tarsus.

In the early horse series (*Hyracotherium*), in which the radius is enlarged and the ulna reduced more rapidly than in any other, the ectal displacement of the lunar is not so uniform nor so rapid as in the *Rhinoceros* series in which these bones retain approximately their primitive proportions. Compare the *Triplopus* carpus, with the scaphoid resting chiefly upon the magnum and the lunar resting wholly upon the unciform, anteriorly, as a type of extreme displacement, with that of *Hyracotherium* or *Epihippus*, in which the displacement is slight. The latter presents much less divergence from the taxeopod type, although the ulna is proportionately more reduced. We meet still greater difficulties in the pes, where, as seen by the contrasts in the members of the *Equus*, *Hyracodon* and *Rhinoceros* series, the extension of the astragalus upon the cuboid is seen to be entirely independent of tibial enlargement. Nor is this extension a resultant of weight, as proven by the diversity of the cuboastragalar articulation in *Dendrohyrax* and *Hyrax*. We reach the conclusion that while the direction of the displacement may be determined by the transmission of the main weight through the ental or ectal side, the degree of displacement is not proportionate to this enlargement, but is modified by other causes.

4. *Growth and reduction* take place by metatrophism, the separate elements of the foot being hypertrophied or atrophied by increased or diminished use, resulting in a transfer of nutrition, one element growing at the expense of another. We have to deal with the adaptations to both vertical pressure and lateral strain, since the motion of the limbs, of the fore limb especially, is not in a perfectly direct line. It may be assumed that the parts grow most rapidly which are subjected to the maximum resultant of these vertical and oblique forces. As a strong confirmation of the theory of displacement here advanced, it may be mentioned that from a study of the resistant facets the writer reached independently the same conclusions as to the motion of the fore feet as those drawn from the study of instantaneous photographs.

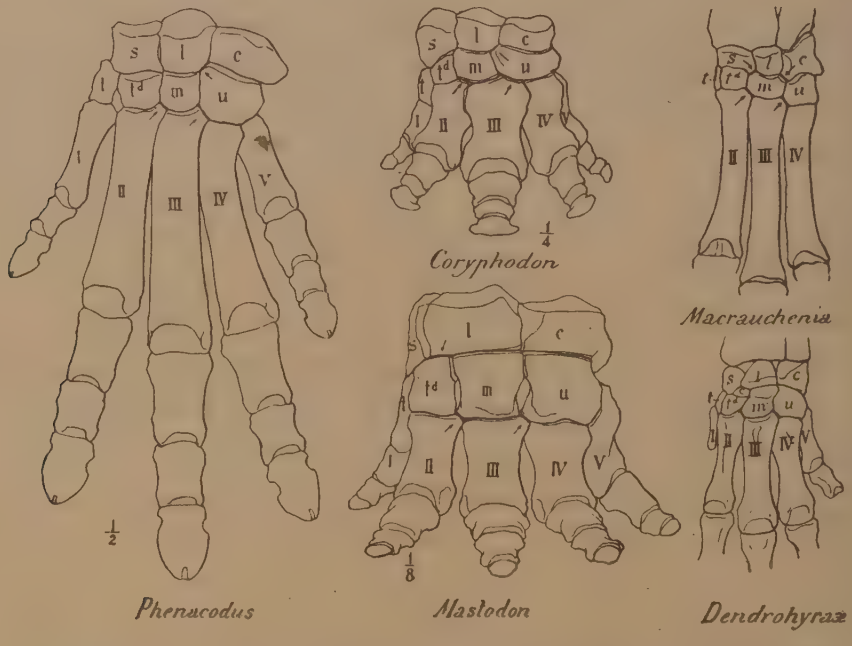
5. We are indebted to Prof. Harrison Allen's* studies of the celebrated Muybridge photographs for the following laws of quadrupedal motion: As the fore foot descends it passes under the body (p. 51), *i. e.*, inwards; striking the ground, it arrests the torsion of the trunk as the shoulder is turning forwards towards the opposite side (p. 57); it strikes upon the outer border (p. 88) and leaves by the inner border (p. 50), so that the pressure of the body is borne from without inwards across the foot; as the foot is raised the sole is everted (p. 50). It follows (*nobis*) that to strike upon the outer border the sole must be slightly inverted as the foot is lowered; secondly, in so far as the trunk torsion is transmitted to the feet, the feet must be rotating upon their own axis from the outer to the inner side. Let us first see how this theory of foot motion agrees with the metapodial displacement.

6. The *metapodial displacement* is practically uniform throughout the Ungulata in the carpus, but very diverse in the tarsus. This difference is undoubtedly due to the fact that the fore foot is for support, the hind foot for propulsion. The latter moves forwards and backwards in a nearly straight line, thus the metapodials are variously displaced in accordance with slight lateral variations in this orthal movement. In the manus the second and third metacarpals invariably have ectal facets upon the magnum and unciform respectively. The only variation is in the adaptively reduced Artiodactyla in which the third metacarpal spreads also upon the trapezoid (Diag. 9). This disposition of the facets is perfectly adapted to resist the strain upon the metapodials as the foot swings inward in descent, this motion being universal among the primitive types. Thus the ectal displacement of the metapodials begins with the elevation of the wrist joint and precedes the intercarpal displacement (see *Phenacodus*, Diag. 8). It does not advance but appears to be retarded by the elongation of the metapodials, as in the palæothere and equine line, as the lateral motion diminishes. The extension of these carpo-metacarpal facets is largely a matter of reciprocal growth, *i. e.*, the unciform, for example, extends inwards as the third metacarpal extends outwards (compare Diags. 8, 9).

7. *Growth of the scaphoid and unciform.* As a result of metacarpal displacement and of digital reduction, the unciform, already supporting the fourth and fifth digits, received a portion of the third digit. As the fifth digit persisted longer than the first, both the motion of the foot striking upon the outer border and the transmission of the direct weight through three digits contributed the maximum vertical and lateral strain to the ectal side of the second row of carpals and especially to the unciform, while in the bones of the first row the ental side, the scaphoid and lunar,

*The Muybridge Work at the University of Pennsylvania. Materials for a Memoir upon Animal Locomotion. By Harrison Allen, Phila., 1888.

received the maximum pressure and lateral strain. At the same time, the ectal or ulnar side of the upper row and ental or radial side of the second row received a diminished pressure and strain by the reduction of the ulna and loss of the first digit respectively.* At all events the scaphoid grew outwards and the unciform grew inwards in all the Diplarthra; they thrust the lunar and magnum apart over the unciform and beneath the scaphoid respectively, in many cases without any actual or relative increase in the size of these elements, as demonstrated by the extremely small size of both the magnum and lunar in the greatly displaced carpus of *Triplopus* or *Hyracodon*. Thus what appears to be a *rotation* of the bones of the upper



DIAG. 8.—The displacement of the bones of the manus in the Ungulata, I. *Phenacodus primævus*, from original in the Cope collection. *Coryphodon hamatus*, after Marsh. *Dendrohyrax arboreus*, from original in the Princeton collection. *Macrauchenia patachonica*, after Gervais. *Mastodon Americanus* from original in Princeton collection. The oblique arrows indicate the direction of displacement.

row upon the second row, is in reality the growth of the scaphoid and unciform towards the median axis of the foot. This is carried to its extreme in the tridactyl Perissodactyla, in which the mesial borders of the unciform and scaphoid are almost in contact in the mesaxial line, *i. e.*, in the line carried through the middle toe.

This explanation is still inadequate, because we find, first, that under certain conditions the lunar shows a marked tendency to expand, and secondly, the mesial growth of the scaphoid and unciform ceases.

* A convenient illustration of the effect of digital reduction upon the carpals was remarked by Dr. Scott in the reduction of the scaphoid in the inadaptively reduced Artiodactyla—the scaphoid resting upon the trapezoid and the trapezium supporting the functionless second digit only.

8. *Reduction and displacement.* There is unquestionably an intimate connection between the reduction of the lateral toes and displacement. Ryder* has pointed out that where the strains are equally distributed among all the digits, there is rarely any specialization of toes, and that in general the reduction of the digits is in direct ratio to the increase of mechanical strains and the frequency and severity of impacts.

Cope† has recently assigned displacement as a cause or as preceding digital reduction. This supposition is rendered improbable by the numerous instances of reduction without displacement, for instance, the first digit of the manus and first and fifth digits of the pes in *Hyrax;* secondly, by the numerous cases of extreme reduction, as in the *Pecora*, with limited displacement.

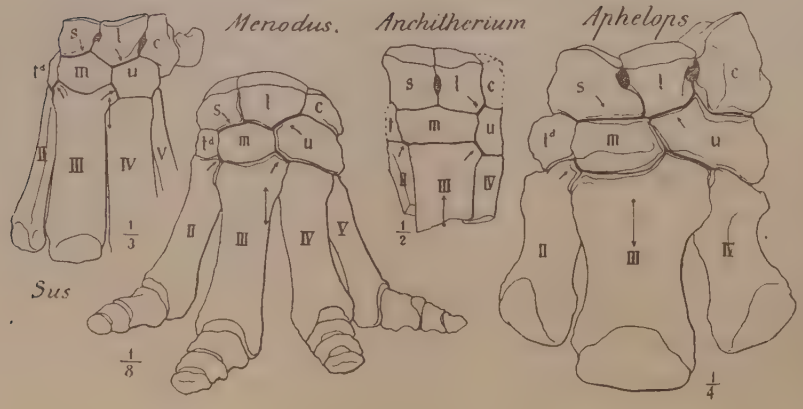
Now if we consider the manus with reference to the correlation of certain types of reduction and displacement, without reference to phylogeny, we find six types:

I. The first type is theoretical, and will be found among the Puerco Condylarthra. In it there is no reduction or displacement.‡ *Phenacodus* is the nearest known representative, in which, however, there is initial reduction, metapodial displacement, slight intercarpal displacement, and a marked tendency to the mesaxonic type. II. The second type embraces the Amblypoda, with the lunar strongly and the scaphoid slightly or not at all displaced. There is no distinct median axis. III. The third or proboscidian type differs from the last only in the direction of the lunar displacement, which is usually upon the trapezoid. The median axis is not well defined. IV. The fourth type is shown in a typical condition in *Titanotherium*, also more or less marked in all tetradactyl Perissodactyla, as well as in all tetradactyl and didactyl Artiodactyla; it represents a stage in which the perissodactyl foot approaches the artiodactyl, the third and fourth toes spreading upon either side of the mesaxial line; the displacement of the carpals is apparently arrested, the lunar retaining some foothold upon the magnum. All tridactyl and monodactyl ungulates pass through this stage. V. The fifth type is invariably associated with tridactylism, incipient (*Hyrachyus*) or advanced (*Aphelops*), in which displacement is carried to an extreme and the mesaxial line passes directly through the third digit. VI. The sixth is associated with monodactylism and entire loss of lateral motion, in which the primitive displacement is counteracted by the growth of the magnum. VII. The seventh is represented in *Macrauchenia*, the lunar showing extreme reduction, both the scaphoid and unciform articulating with the magnum.

* On the Laws of Digital Reduction. American Naturalist, 1877, p. 603.

† "This rotation has resulted, sooner or later, in the loss of the first digit." American Naturalist, 1889, p. 986.

‡ The pes of *Periptychus* is so closely similar to that of the bear, the manus may be assumed to be of the same type.



First. In Types II and III the unreduced, nearly isodactyl and semiplantigrade forms, the *Amblypoda* and *Proboscidia*, the unspecialized spreading toes transmit the strain from every side. We observe a marked increase in the size of the lunar. Among the Proboscidia the lunar either rests upon the magnum only or upon the magnum and trapezoid; this is the common condition; or upon the magnum, trapezoid and unciform (see page 539).

Second. In all the genera of the reduced types, excepting the highly specialized Types VI and VII, it is a remarkable fact that the scapho-magnum and lunar unciform facets are subequal. It appears from a comparison of the vast number of forms included in Types IV–VI, that reduction, altering as it does the entire system of digital strains, has had some definite influence in limiting or widening the extent of these facets, and that Prof. Cope has put the effect before the cause in stating that displacement precedes reduction. Schlosser has rightly reversed this relation.*

The permanent tetradactyl condition in the perissodactyls of Type IV, like the artiodactyl didactylism is paraxonic, *i. e.*, the greatest vertical strain is not transmitted directly through the median toe but between the third and fourth toes, this, with the lateral strain coming from the functional fifth toe, in some manner limits the growth of the scaphoid and unciform, and in many instances results in the spreading of the lunar in both directions; it will be observed that in nearly every case the lunar is directly in the mesaxonic line. Where the four toes spread, as in *Titanotherium*, the metapodial strains must be somewhat analogous to those in the Proboscidia and Amblypoda—at all events the growth of the lunar in each instance suggests such an analogy.

As this condition of the lunar occurs in widely separated phyla and in a large

Op. cit., p. 113: "Gleichzeitig mit dieser Reduktion der Seitenzehen findet auch eine Aenderung in der Anordnung der Carpalien und Tarsalien statt."

number of forms, it cannot be due to mere coincidence, but must be the result of certain modifications of the pressure and strain transmitted to the carpus in paraxonic types. The loss of the lateral toes in the highly reduced Artiodactyla, in which the pressure is most perfectly divided between mts. III and IV, from Eocene to recent times, has not been accompanied by any alterations of the relations of the lunar to the magnum and unciform (see Anoplotherium and Cervus), apparently because there is no alteration in the axis of the metapodium. But in the Perissodactyla the reduction of mc. V, as can be readily observed in the rhinoceroses (see De Blainville, Osteographie, *R. tetradactylus* of Auvergne, of Sansans, and *R. sumatrensis, unicornis, bicornis*), is accompanied step by step by the displacement of the lunar from the magnum. Lateral compression of the carpus has nothing to do with this displacement, because the tapir, which is even now in the transition stage between Types IV and V, has a much narrower carpus than *Aphelops*. The tapir manus is now in the stage of evolution which was passed by the rhinoceros in the Miocene period.

It follows from these cases that reduction *per se* does not influence displacement, but only in so far as (in the Perissodactyla) by releasing the carpus from the pressure of the V digit it brings the major axis directly through the centre of the third digit, as seen in Type V. This type thus embraces a large number of forms, in which reduction of the fifth digit has been very rapid. The writer can find no exceptions to the law that mesaxonic tridactyl types of all the Tertiary periods show the extreme of diplarthrism.*

Dr. Scott has called the writer's attention to a third correlation of the lunar and reduction, as found by a comparison of the lunar, scaphoid and unciform in the adaptive and inadaptive Artiodactyla. In the inadaptive types (Enteledon, Anoplotherium, etc., see Kowalevsky) the lunar is enlarged at the expense of the scaphoid; the latter resting upon the trapezoid, which in turn supports only the rudimentary second digit, the third digit forming no trapezoidal union. In the adaptive types, on the other hand, the third digit acquiring a trapezoidal facet, the scaphoid is somewhat larger and the lunar less enlarged.

Tarsus.

The above observations apply chiefly to the carpus, but precisely the same principles operate in the tarsal displacements.

*The manus of *Palæotherium medium*, as figured by Kowalevsky (Palæontographica, Bd. XXII, Taf. VII), presents an exception. But reference to De Blainville's figure and to a cast of the original foot recently presented to Princeton by the Paris Museum, shows that Kowalevsky's figure is incorrect. There is no extensive lunar magnum facet, such as he represents.

The rapid reduction of the fibula accompanying the orthal movement of the limb hastens the displacement of the astragalus, in advance of any displacement in the carpus.

The growth of the astragalus upon the cuboid and the cuboid beneath the astragalus are reciprocal. The former may be compared to the scaphoid and lunar displacement, the latter to the growth of the unciform beneath the lunar, *i. e.*, towards the mesaxial line.

The line of association of reduction with certain forms of displacement observed in the manus has a parallel in the astragalo-cuboidal displacement. It will be observed that in the artiodactyl or paraxonic types there was a primitive disposition to form an astragalo-cuboidal facet, adapting the middle axis of the astragalus and calcaneum to the middle axis of the metapodium, which here passes between the second and third digits. On the other hand the *Hyracotherium*, *Paloplotherium* and *Hyracodon* mesaxonic types, as they all tend to monodactylism, show an arrest of displacement, owing to the growth of the third digit producing conditions similar to those in the monodactyl carpus; while genera of the iso-tridactyl mesaxonic type, the tapir, rhinoceros, etc., all show extreme astragalo-cuboidal displacement exactly parallel to that in the carpus.

Conclusions.

The laws of adaptation of the serial plantigrade foot to digitigradism may be summarized as follows:

1. Displacement is effected by the growth, arrested growth, or reduction of different elements, and takes place in the direction of the greatest lateral strain, being most rapid in the elements which are subjected to the maximum vertical impact and lateral strain.

2. The direction and degree of intercarpal displacements are adapted to the gradual alteration of the major axes in the bones of the fore arm and of the metapodium respectively, as brought about by reduction, and tend to maintain these proximal and distal axes in the same vertical line.

3. The initial displacement, however, preceding and independent of reduction, is the ectal movement of the metapodials, adapting these elements to resist the strain of the "stroke" upon the outer border, as the foot extends downwards and inwards.

4. In the unreduced isodactyl types, the strain of the spreading metapodials

converges to the centre of the carpus, without a defined median digital axis, and the lunar spreads to the ectal or ental side according as the respective growth of the radius or ulna alters the major axis of the fore arm.

5. In the Diplarthra the major axis of the fore arm passes through the radius, and through the third digit (Mesaxonia) or between the second and third digits (Paraxonia). The outward displacement of the entire upper upon the lower row of carpals is apparent, not real; the magnum and lunar are arrested in growth, and the lunar remains almost directly in the mesaxial line; what actually takes place is the ental growth of the unciform and ectal growth of the scaphoid towards the mesaxial line, thrusting the magnum and lunar apart.

6. This growth is affected by the reduction of the lateral digits in so far as this alters their relation to the major axis of the metapodium. Where reduction leaves the major axis between the third and fourth digits, this growth is arrested; where it leaves it directly through the third digit it is extreme; where the third digit alone transmits the main impact, the displacement is neutralized by the growth of the elements which directly support this digit (*i. e.*, magnum and cuneiform 3).

EXPLANATION OF PLATES.

Plate VII.

PROTOREODON PARVUS.

Fig. 1. Skull, side view; 1*a*, base of skull and superior molars; 1*b*, brain from above; *ss*, sylvian gyrus; *l*, lateral; *m*, median gyrus.

2. Inferior molars, internal view; 2*a*, crown view.

3. Portion of carpus with first digit.

4. Humerus, anterior view of distal end.

5. Tibia and fibula, anterior view; 5*a*, distal view.

6. Pes, anterior view, of a larger individual.

7. Phalanges, of fourth digit.

8. Metatarsal II, medial side of proximal end; c_2, facet for mesocuneiform; c_3, for entocuneiform.

LEPTOTRAGULUS PROAVUS.

9. Lower jaw, side view, combined from specimens shown in Figs. 10 and 11.

10. Lower jaw, inner view, showing pm. 4 and m. 1; *a*, crown view.

11. Second and third lower molars of another specimen, inner view; *a*, crown view.

12. Ulna and radius, proximal end.

13. Scapula, distal end; 13*a*, glenoid cavity.

14. Metacarpal IV, anterior view; 14*a*, proximal end; *u*, facet for unciform.

15. Portion of tarsus, anterior view.

16. Cuboid.

(Figures natural size.)

Plate VIII.

DIPLACODON, see page 514.

Fig. 1–1*a*. Fifth cervical vertebra, anterior view, lateral view.

2. Dorsal vertebra, between *d.* 7 and *d.* 10.

3–4. Lumbar vertebra, lateral view, posterior view.

5. Femur, anterior view; 5*a*, external view; 5*b*, distal view.

6. Tibia, anterior view; 6*a*, distal view.

7. Left *os innominatum*, lateral view. × $\frac{1}{5}$.

8. Calcaneum and astragalus, front; 8*a*, external; 8*b*, posterior view of astragalus; *c*, distal view.

9. Carpals, proximal row; probably belonging to a young individual; *a*, proximal surfaces. Reference to *Diplacodon* uncertain.

Plate IX.

DIPLACODON, see pages 515–16.

Fig. 10. Ulna and radius, external view; 10*a*, distal view; 10*b*, anterior view; 10*c*, internal view.

11. Humerus, posterior view; 11*a*, external view.

12. Left scapula, outer surface, × $\frac{1}{5}$; *a*, glenoid fossa.

13. Right manus, × 1; the carpals are restored from *Palæosyops* and *Titanotherium;* the metacarpals are slightly foreshortened; *b*, mcs. II–IV, proximal view; *a*, mc. IV, distal view, × $\frac{2}{3}$.

14. Superior molar, probably m^2.

15. Axis, belonging to a smaller individual; side view.

Plate X.

ISECTOLOPHUS ANNECTENS, see page 520.

Fig. 1. Superior molars of left side; 1*a*, external view of same.
2. Inferior molars, crown view; 2*a*, external view of m_3.
11. Inferior series of a younger individual (No. 10,399).
3. Left carpus, front view, with the metacarpals partly restored.
4. Right cuboid, external view; 4*a*, anterior view; 4*b*, superior view, showing *ac* (astragalar) and *cc* (calcaneal) facets.
5. Phalanges probably belonging to the second and third digits.
6. Metatarsals, distal portion, probably of III and IV; *a*, distal faces of same.
7. Tibia, distal face.
8. Proximal view of radius and ulna.

AMYNODON INTERMEDIUS, see page 508.

10. Palate and superior dentition; 10*a*, side view of superior dentition.

MESONYX UINTENSIS.

9. Inferior premolar-molar series, internal view.

Plate XI.

PLESIARCTOMYS SCIUROIDES.

Fig. 1. Skull, from above; 1*a*, base of skull; 1*b*, side of skull; 1*c*, crowns of superior molars; 1*d*, crowns of inferior molars and incisor.
2. Tibia, side view; 2*a*, humerus, side view.

EPIHIPPUS UINTENSIS, see page 529.

3. Lower jaw, from above; 3*a*, side view.
4. Forearm and manus, front view; 4*a*, side view.
5. Tarsus, front view.

TRIPLOPUS OBLIQUIDENS, see page 525.

6. Superior molars, crown view; 6*a*, external view.
7. Inferior molars and alveoli, type of *T. obliquidens* (No. 10,402).
8. Manus, front view.
9. Pes, front view.
10. Third superior molar (No. 10,402).

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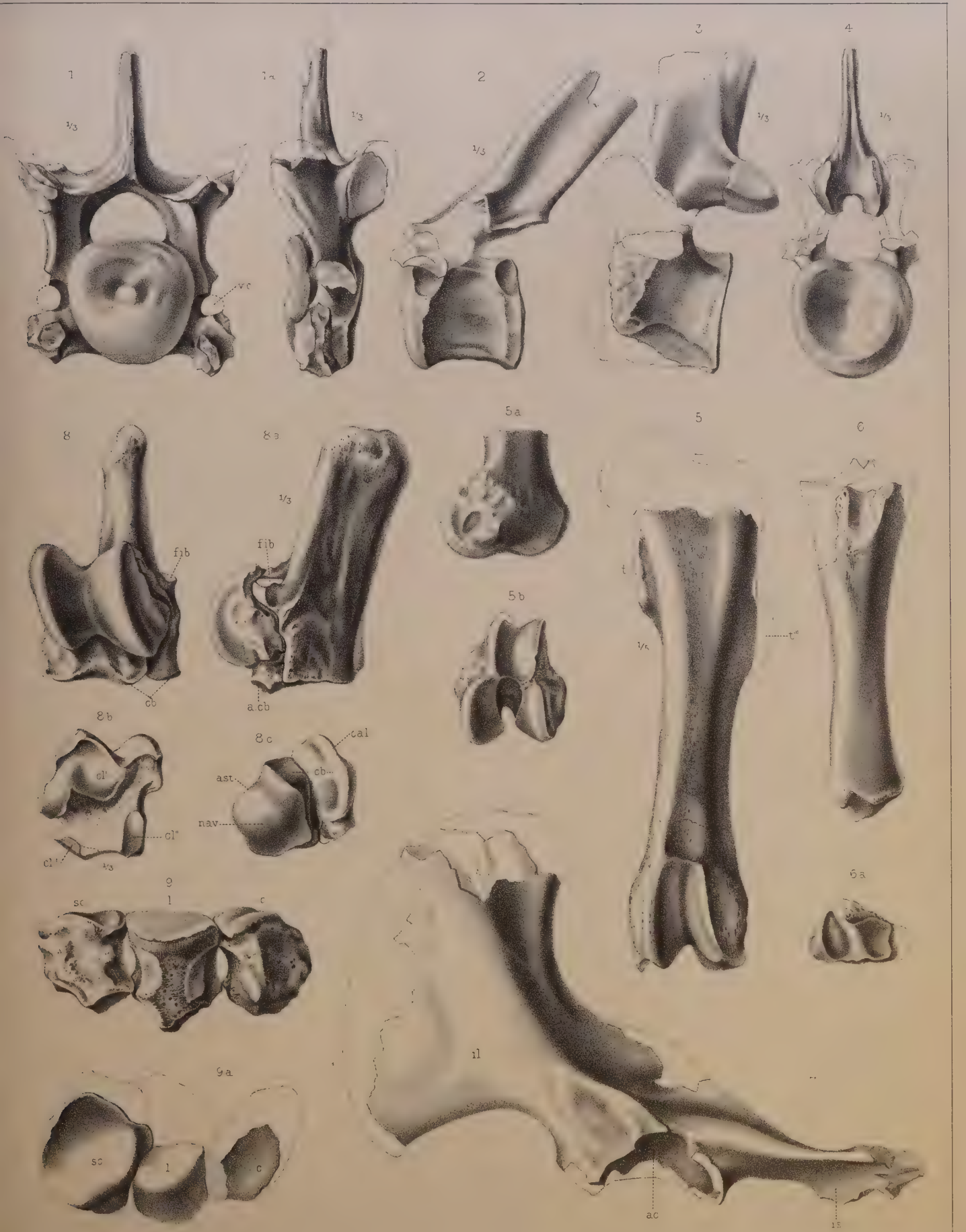
PROTOREODON, 1-8. LEPTOTRAGULUS, 9-16



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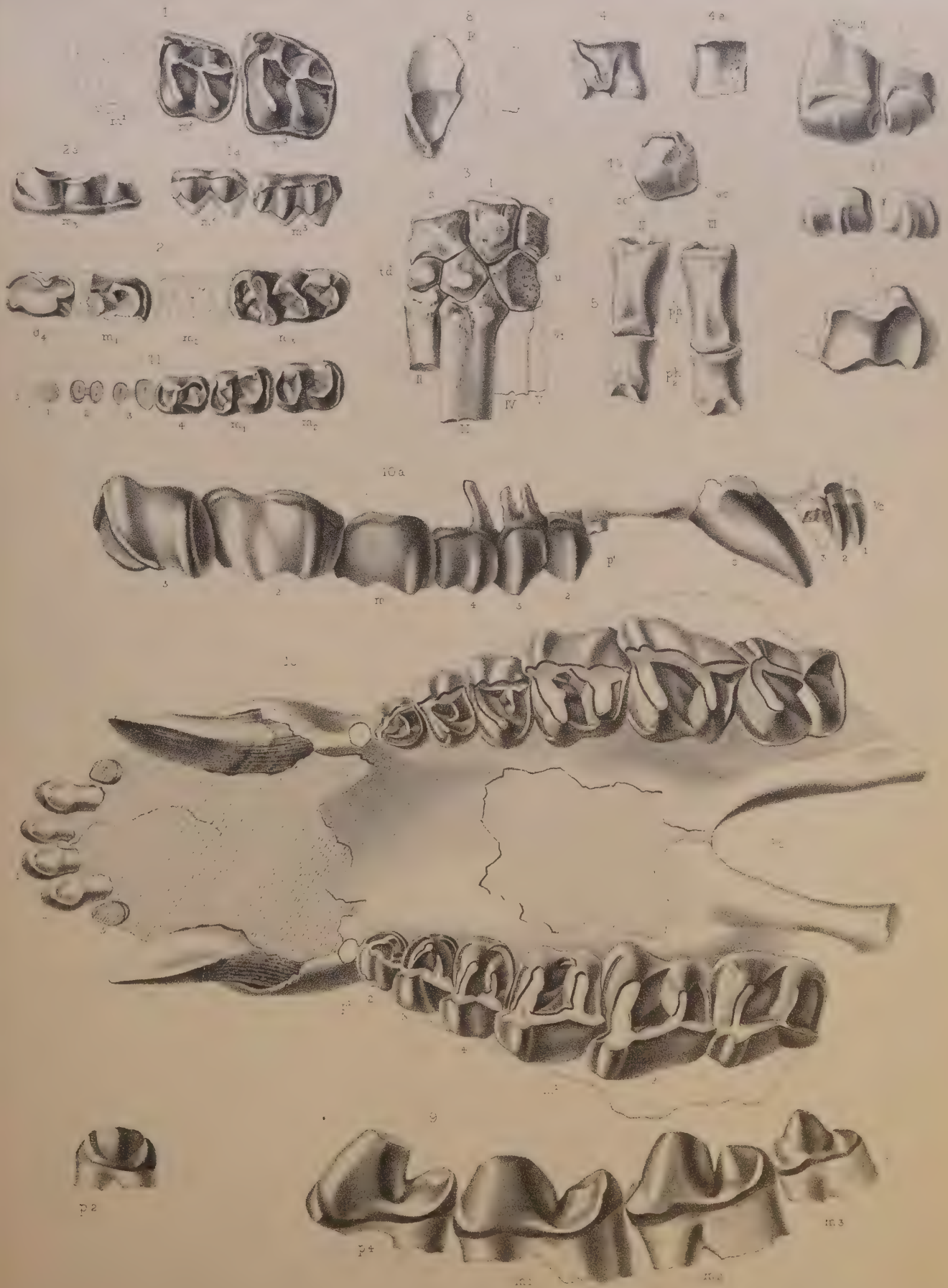
DIPLACODON.



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HECTOLOPHUS 1-8 ANYNODON, 10-10a. MESONYX, 9.

R. Weber, del..

Lith. Anst. v. Werner & Winter, Frankfurt a/M.

PLESIARCTOMYS, 1-2a. EPIHIPPUS, 3-5. TRIPLOPUS, 6-10.

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